# GUIDE
# TECHNOLOGICAL SOLUTIONS


Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND
FLAGSHIP
EFFECT4buildings

**PUBLISHED**
Published by the EFFECT4builings project
September 2020

**PROJECT WEBSITE**
www.effect4buildings.se/

**TEXT PRODUCED BY PARTNERS**
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Investments in energy efficiency are not currently happening at the rate needed, hindered by barriers such as high upfront costs, lack of access to finance, high perceived risk, lack of trust in new technologies, competing investment priorities, lack of knowledge, awareness and personal resources, and split incentives. Many of these barriers can be overcome, at least significant part, with well-designed financial tools and instruments.

The Interreg Baltic Sea Region Program 2014-2020 project EFFECT4buildings is providing building owners and managers with a set of financial tools and instruments to support the implementation of more energy efficiency measures, developed, and improved in real cases.

The main target group is building managers in charge of public or privately owned building portfolio.

**The nine tools are:**

- Convincing Decision makers
- Financial calculations
- Bundling
- Funding
- Energy Performance Contracting
- Multi Service Contracting
- Green Lease Contracting
- Prosumerism

EFFECT4buildings was implemented from 2017 to 2020 with the support from the Interreg Baltic Sea Region Programme 2014-2020. There were seven partner countries – Denmark, Estonia, Finland, Latvia, Norway, Poland, Sweden.

The project was also a part of the implementation of the EU Strategy for the Baltic Sea Region (EUSBSR), being a flagship project under policy area Energy and the horizonal action Sustainable development. Flagship projects demonstrate the progress of the EUSBSR and serve as pilot examples for desired change.

**The full toolbox can be found on project webpage: www.effect4buildings.se**

# TECHNOLOGICAL SOLUTIONS

Companies who produce innovative technological solutions based on latest knowledge need more information on the needs of the public building owners. Public building managers need better knowledge on existing solutions, their profitability and how to order them to benefit the highest possible value.

The tool consists of following elements that aim to enhance the dialogue between building managers and technology solution providers:

- an excel-list of mapped innovative technological solutions that are available in the Baltic Sea Region;
- building managers´ experiences on different technological solutions;
- evaluation of certain technological solutions such as centralized vs. decentralized ventilation, healthy and circadian lightning, thermal heating systems;
- guidelines and templates for procuring solar energy PV plants, indoor climate; light, thermal, air quality and acoustics, EPC and energy monitoring systems.

## Let's understand the problem

As EU has set a target for all new buildings to be nearly zero-energy by 2020, currently about 35% of the buildings are over 50 years old and almost 75% of the building stock is energy inefficient. Thus, smart and validated solutions are inevitable.Buildings are the largest energy-consuming sector in the world, accounting for overdone third of all carbon emissions. 75–90% of OECD building stock will still be in service by 2050. Yet the performance of most existing buildings is below current standards. Energy efficiency in buildings is a key focus in European and global climate and energy policies. Building energy efficiency has not increased in recent decades compared to other sectors especially transportation. Building component technologies have become more energy efficient but buildings as a whole have not.

A new approach to energy system integration and the extension of the research at district and community levels have started but still require supplementary developments.
Computational tools are necessary to take account of the complexity of buildings during design, assessment and operation. These should be supported by a series of targeted tools and solutions enabling better

decision-making, plus education and awareness on available innovative techniques. It is known that energy efficiency planning can be much more efficient when constructing a new building. It starts with the correct positioning of the building and the selection of the building envelope. But when it comes to renovating existing buildings, experience and proper planning require guidance and the experience of others.

To support building managers in taking investment decisions in energy efficiency solutions they need a better overview of available solutions, more knowledge about the technic as well as their profitability, together with experience from other that has implementing the solutions. At the same time, solution providers need feed-back from the market on new needs.

# Solution

This is more than a technological challenge; the technology needed to achieve reduction in building energy use exists. Wise thinking, knowledge, experience is the basis for maximum results.

## Available solutions

The catalogue of available technological solution mapped and recommended by project partners can be found in the annex to this guide. The list is up-to-date and often contains various references. It consists of 162 solutions grouped into 8 categories:

Building envelope (24 solutions):
In this category energy efficient and environmentally friendly solutions are listed. Here we see different insulation solutions, energy saving glass on existing windows, highly energy efficient external doors, integrated solar roof and solar facade solutions, different eco materials, wood building systems and installation techniques.

Ventilation (19 solutions):
This category includes different heat recovery ventilation systems, smart ventilation systems, ventilation sensors, managing and controlling systems, software solutions.

Heating and cooling (22 solutions):
Heating and cooling category includes combined heat and power plant, wood stoves and boilers and systems for wood chip burners. Hybrid heat pumps, heat recovery heat pumps and air treatment units. Radiant heating and cooling systems. Heat recovery from wastewater.

Water (11 solutions):
Water solutions are associated with both heat savings and utility water savings. There are simple and often affordable solutions for this. Our list contains solutions for heat exchanger for wastewater (for swimming halls, sport arenas and hotels that uses a lot of water), energy efficient tap water taps/showers, radiator thermostats and the automatic differential pressure controllers and more.

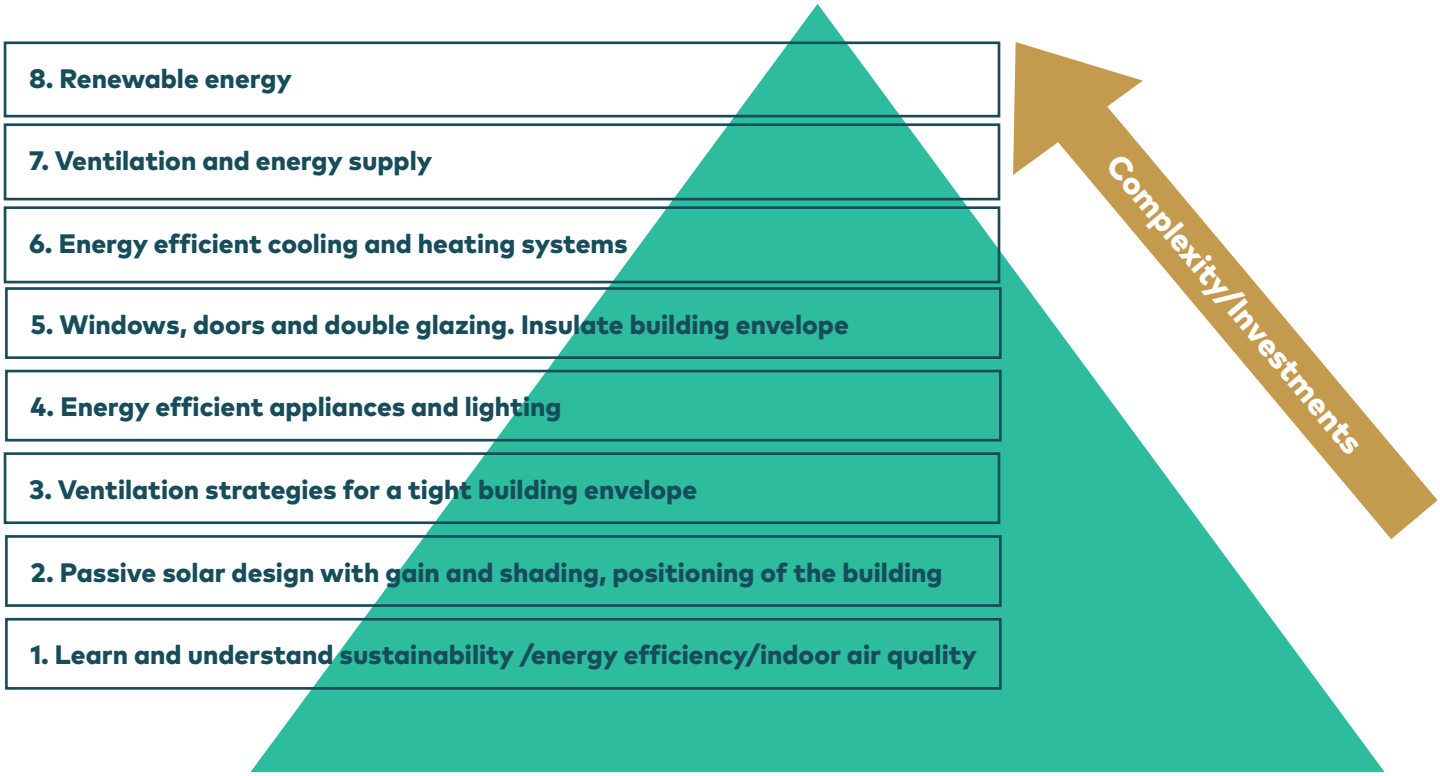



FIGURE 1. THE PYRAMID FOR RENOVATING SMARTER

Lighting (16 solutions):
Outdoor and indoor lightning with IoT backed up systems, from standard office solutions to solutions with special needs. Solutions that save up to 70% energy.

Electricity (20 solutions):
There are many photovoltaic solutions in this category, ranging from services to energy distribution to cable management and building automation. Includes power optimiser and micro-inverters for solar panels and solar power consumption and management systems.

Building management systems/ICT solutions (37 solutions):
There are most companies in this category. Mainly we find here managing, monitoring and visualization systems. Building automation, regulation and smart metering solutions. And demand-controlled solutions.

Others (13 solutions):
This category includes special solutions that can be placed under several categories at the same time. It's a good inspiration. What is done already and what can be done at all. All solutions focus on savings, both in terms of environment and money/energy.

The EFFECT4building project highlight some solutions of special interest and with the capacity to reach a larger market in the Baltic Sea Region. The catalogue of energy efficient solutions also contains articles about those solution providers, some of them also presented in a recorded webinar.

## Experience and profitability of the solutions

Interviews by project partners, with nearly forty building managers, highlight experience from using many of the proposed solutions. Questions were asked about issues connected to technological solutions. Questions were also asked about experiences from technological solutions as well as what their needs are. We received comprehensive answers. Mostly are building managers satisfied with the improvements and the result is good. You can find a summary of the interviews in the appendix to the document.

To find out how profitable different categories of solutions in general are, an analyse of 500 energy audits with a total of 5 000 energy measures in Swedish real estate companies has been done. By calculating saved MWh per invested 100€ (MWh/100€) the most cost-effective measures have been identified. Results are presented in a web-tool as well as in fact sheets for four categories:

For **heating** the most common measures are to improve insulation of the building and to reduce the indoor temperature, but also investments in new heating systems. The most cost-effective measures, that makes sense to start with, is to make sure indoor temperature is set correctly and to seal the building from leakage.

For **cooling** the most common measure is to invest in new/other cooling systems, while the most cost-effective measure is to maintain/adjust the cooling system correctly.

For **ventilation** the most common measures are to invest in time control of ventilation or to invest in whole new units. The most cost-effective measure is to invest in time control or demand control.

For **lighting** the most common measures are to invest in more efficient luminaries, but the most cost-effective measure is to invest in presence control.

To make such analysis possible data from energy audits need to be standardized and collected into a common database.

## Summary/conclusions from the cases

We have a very good description of how to obtain photovoltaic solutions. Things to look out for that should be considered. This material can be found in the annex "Technical description for procurement of photovoltaics systems" document.

## New needs

Based on interviews with target group there is a need of new or better solutions for to see all the parts together. Continuous development and monitoring are required. Good knowledge of the different types of financing is also very helpful. Knowledge has the greatest impact. Old opinions are very rooted. Public building managers are open for new knowledges and example cases. We believe that regular innovation meetings should be held at least twice a year.

# Experiences and recommendations

The market for energy efficiency solutions in the Baltic Sea Region is growing and there is a large range of offers. Building managers have limited financial resources and are restricted in terms of taking financial risks. In addition to that, technical building systems are integrated, and each solution need to be carefully

evaluated in combination with other already existing systems. Because of this, building managers need to be well assure that the solution that they invest in really will perform as expected. For this, the performance of a technology solution has to be confirmed by other building managers, sharing experience that they actual work. Investment decisions cannot be taken only based on sale pressure. Based on our practice, more meetings between public building managers and technology providers should be organized. This must be done in the framework of an explanatory seminar. To organize such meetings well, we recommend involve independent parties, like Effect4buildings partners. Asking feedback and organizing follow-up meetings are recommended.

To standardize categories for energy efficient solutions in energy audit and collecting data from them into a common platform/database will generate valuable knowledge and help other building managers to identify possible solutions. Standardization make benchmarking possible and could also lower the cost for energy surveys. Such platforms do not exist today and should be promoted in the Baltic Sea Region.

# Combination with other tools

Technological solutions are part of each tool and can also be used as additions. A vast array of different energy efficiency measures popular in the Baltic Sea area are presented in the technological solution guide. In addition, there is a longer description of a new energy monitoring system/software (EMS) that helps to measure and monitor the savings made with other energy efficiency measures. It works well in combination with EPC, MSC and Prosumerism.

# Conclusions

Several results have arisen from this project on cost-effectiveness and reliability of products and technologies, and from "low-energy" and "nearly zero-energy" buildings for penetration in the market. Although progress is being made, deep renovation remains a priority if the potential for substantial savings and multiple related benefits is to be realized.

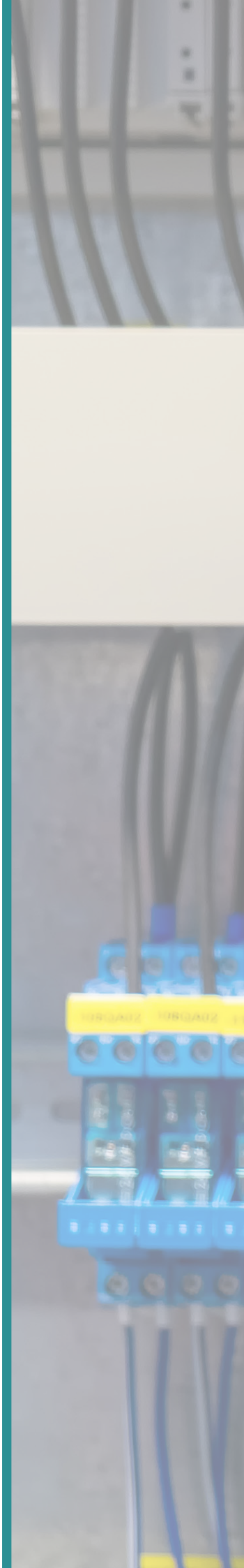
With technical solutions, the best effect is achieved when domains are implemented together, integrated or synchronized with each other. Projects that look at all possible improvement in different categories together are most successful. Categories we consider important here are building envelope, ventilation, heating and cooling, water usage, lighting, electricity usage and building management systems.

# TOOLS

1. Technological solutions for energy efficiency
2. Experiences and procurement of technological solution

## FIND ALL TOOLS HERE

www.effect4buildings.se/toolbox/technological-solutions/

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