

# Energy Retrofitting of Buildings



**Targeting Municipalities and  
Homeowners Associations**

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ISBN: 87-92044-02-6

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Issued: December 2006

The report can be read and downloaded from the homepage of the Danish Ecological Council: [www.ecocouncil.dk](http://www.ecocouncil.dk) or the website of the Climate programme of the Danish Environmental Protection Agency [www.danishcarbon.dk](http://www.danishcarbon.dk)

The work was funded by the Danish Environmental Protection Agency.

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# Introduction

Some people are freezing during the cold winter. The district heating systems are old and unreliable. Sometimes the heat is not working for a long time and is just not being repaired. People do not know what to do in order to ensure having heat during the cold winters, and for that reason some residents

disconnect from the district heating system and install their own gas boilers. However, this is not reasonable for the society. It is much cheaper for the society as a whole to use district heating for heating the blocks of flats throughout the countries instead of individual gas boilers, and at the same time it would be a good idea to insulate the buildings, among other things, in order to reduce the energy use. It's not unusual to see twice as much energy used for heating in Eastern European countries than in

Western European countries, per the same living area and under similar climate conditions.

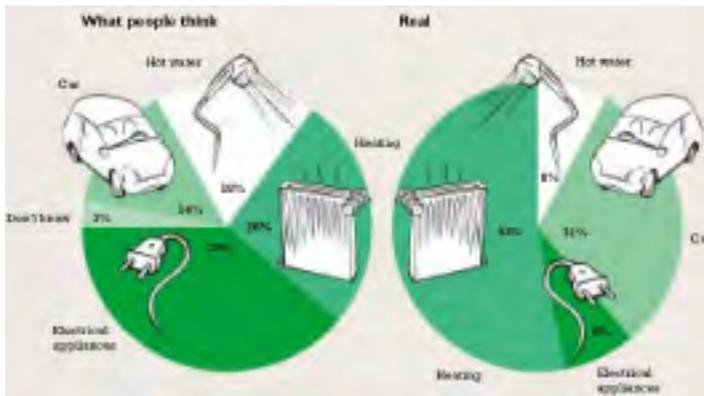
**This brochure** describes energy saving measures which could be introduced in residential buildings: both more simple measures, which can easily be done by individual residents, but also more costly energy retrofitting measures, where mutual financing has to be organised for all residents in a block of flats. For this reason, this brochure also consists of a brief description of the financial possibilities for energy efficiency improvements, including Joint Implementation, which is one of the so-called Kyoto mechanisms that can attract parts of the finance needed.



*Thermographic photos reveal energy loss.  
Red areas are the most poorly insulated*

# Where do you spend your energy?

People often think that they spend the largest part of their energy consumption on electricity. However, a German survey showed that most people think that they use a quarter of their energy consumption on heat, where it actually is twice as much --- half of the energy consumption. This means that there is a larger energy saving potential from the heat consumption, than people often think.



## Technologies



In this brochure the technologies to be used for saving energy in residential buildings have been divided into two levels. The first level concerns the easy and cheap measures and the second level concerns the technologies to be used for more substantial energy savings.

# Easy and cheap energy saving measures

Some energy saving measures are so easy and cheap that they can be implemented immediately by residents. One is to install a reflecting plate behind the radiator, and another is to seal the windows so they can be closed properly. These measures will save energy and increase comfort at the same time.

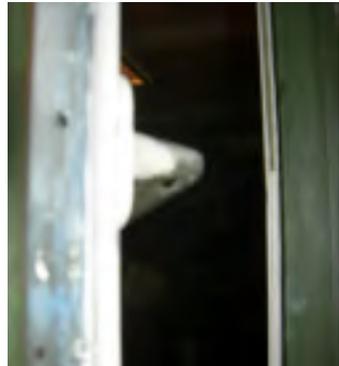
## Reflecting plate behind the radiator

A radiator gives heat to the room in two ways. It heats the air that flows by it and it gives heat with irradiation. As the radiator is placed by the wall, the irradiation from the back of the radiator does not benefit the room. The irradiation to the cold outer wall is lost to the birds. A reflecting plate installed on the wall will redirect the irradiation into the room. Materials used for reflectors are aluminium foil, insulated aluminium foil or special insulation materials. Aluminium foil may reflect up to 97 % of heat radiated. Radiator reflectors can save up to 2-3 % of the total energy consumption of the building.

## Sealing of windows with strips of rubber

Many windows are not really closed when they appear to be closed. Still some cold air is entering the room and the heated air from inside is leaking. The effect from all the unsealed windows in a flat together is the same as if one window in the flat was always open - also in the coldest winter.

Sealing is aimed to reduce infiltration of air into the building and thus decrease the amount of air that has to be heated in order to keep the temperature. Window sealing includes applying special sealing material and necessary repairs of window frames. This may save approximately 4-5% of the energy consumption and significantly improve the comfort.



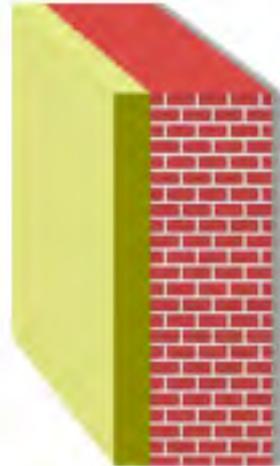
# Building Envelope

The building envelope is the outer shell of the building where the heat loss is. The less heat that is dissolving through the walls and windows, the less heating is required for keeping the temperature. The building envelope consists of the walls, the windows, the door, the roof and the ground. Improvements of the building envelope are thus a collective task for the owners/residents.

## Thermal insulation

Many buildings are made up with bricks without any further insulation or with only very little insulation. Bricks have a high heat capacity and transfer heat very well. A brick wall will thus tend to have the same temperature both outside and inside, transferring the heat from the house outwards.

This changes significantly if the wall is insulated outside with a layer of mineral wool or other material protecting from wind and rain. The mineral wool makes the brick wall warmer since the heat is prevented from being lost to the outside. This will turn the bricks into a heat storage, making the temperature indoors more constant.



## Closing the staircase

The staircase area is a common area that in most cases is surrounded by living area without insulation. If this staircase area is open and cold during the winter it will cool down the walls and thus the living areas, and cost both energy and money.

An open staircase room should therefore be closed and insulated, as well as the rest of the building, with for instance mineral wool on the wall, good low energy windows and possibly a glass roof if there is no roof present. This will stop the heat from leaving without making the room darker.

The improvement also includes having a good insulated entrance door to the

staircase and making sure that the door can close properly and is easy to handle so that it does not remain open. This will significantly increase the temperature and thus diminish the need for using the radiators that now often are mostly losing the heat to the outside air. These energy saving measures will benefit all the residents in a building by reducing the individual heating bills.

## New low energy windows

Windows contribute to a large share of the energy loss of buildings. This is both due to missing sealing as described above, but also due to the heat loss through the window profiles and the glass. New low energy windows can improve this.

Good low energy glass feels warm on the inside even when it is very cold outside and will both improve the energy balance and the comfort of the house.

Low energy windows are thermo windows with at least two layers of glass and usually argon between the glasses. The difference between low energy windows and ordinary thermo windows is the argon and a special coating that is placed on the inner glass making it reflect the heat.



# Heating System

The insulation of the building reduces the energy demand for having a good temperature. The heating system needs to be optimised to deliver heat to compensate for the losses.

The heating system starts with the energy supply to the building, which can be district heating water or a local boiler. From here the energy is distributed around the building for both heating the rooms and for hot water.

To save energy it is essential that the energy is used where it is needed and losses are minimized wherever possible.

The pipes should be made in such a way that it is possible to reach any radiator directly without going through other radiators first. The pipes should be surrounded by insulated tubes so that the water remains warm and the heat is not wasted where it is not needed.



## Heat metering

Heat meters are essential for energy savings as they show how much energy is used. This technology is essential for charging the heat bill according to consumption instead of calculation. This is necessary in order to get individual economic benefits from energy savings. Individual metering in each flat can save 30 % of the energy consumption.

The direct connection between consumption and energy costs for the residents is changing energy habits, since people will start to economise heating and energy saving will be observed even without further energy efficiency investments. If possible and affordable there should be meters in every flat so that people see a direct connection their energy habits and their heating bill.



## Radiator thermostats

Radiator thermostats can significantly improve the comfort while also saving energy. The radiators should be used to maintain a good temperature. This means that the heating from the radiators is constantly adjusted so that it doesn't get too warm or too cold. If it gets too warm residents without the possibility for regulating the radiator's temperature tend to open the windows to get colder air in. The same thing occurs when residents want fast heating of the room that is too cold, and often forget to turn down the heat before the desired temperature is met, which again can create the need for opening the windows.



## Reuse of the hot water from the DH system

Depending on the district heating system it may be relevant to rethink the supply of hot water. The best energy performance is obtained when the district heating water is cooled down as much as possible before it leaves the building and returns through the district heating network to the boiler. In this way the loss in the pipes is reduced and the need for supply of hot water from the district heating system is reduced. If the cooling of the water through the heating network of the building is not sufficient, or just in order to save money, it may be a very good solution to reuse a little percentage of the water coming back from the radiator pipes. This water can then be mixed with warmer water coming from the district heating network running into another circulation in the heating system.

# Financing energy efficiency improvements

Energy is paid for when it is used. This means that there will be an energy bill for all the remaining lifetime of the building. Energy savings can reduce the energy consumption and energy costs for many years ahead. But most of the energy efficiency measures presented above will need investments - which means money to be spent now while the savings will show up later. This requires either that the residents take money out of their pockets or to raise a loan for



the investments. In both cases the investment will ultimately result in money savings.

It is essential that the interest rate for a loan is relatively low and that the life time of the loan is long enough to ensure that the energy savings can pay for the loans. This can be done if there is a guarantee behind the loans so that the banks can be sure to get their money back. Better guarantees give cheaper loans.

Someone has to give the guarantee. In principle it can be the owners of the flats, the municipalities, district heating companies, the state, or the technology suppliers. It is also possible that all these parties form a fund that can give the guarantee. But those who give a guarantee also take a risk and can lose money so it is not likely that they will give the guarantee. The best solution is thus that the guarantee is given by those who have a direct interest in energy savings. This is the owners of the flats, but in case these do not pay the full energy cost today, it could also be for instance the municipalities and the district heating companies.

The decision on investing in energy efficiency and energy savings should be made only after analysis of the building and calculation of the investments and savings. On this basis the owners should take the decision that best reflects the economic ability of the residents as everyone will have to pay their share of the investments - but also get their share of the savings. Normally this will provide installation of individual metering in order to make sure that the single residents get the economic benefit of their savings.

# Financing possibilities by Joint Implementation

Burning less fossil fuel also has crucial environmental benefits. Energy savings are absolutely essential in order to reduce air pollution and global warming.

Most of the countries in the world have declared that climate change is an environmental threat and have committed each other to reduce the emissions of greenhouse gasses such as CO<sub>2</sub>. Most industrialised countries further committed themselves on specific reduction targets in 2008-2012 compared to 1990. This was done in the Kyoto Protocol which entered into force in February 2005. Also Romania/Ukraine has an obligation according to the Kyoto agreement. However, due to the economic breakdown after the communism fall, Ukraine/Romania emits much less CO<sub>2</sub> than their commitments for



the first period in 2008-12. Romania has to reduce its CO<sub>2</sub> emissions with 8 percent compared with the 1989 level. Ukraine can emit the same as in 1990. Although the emission today is below this limit, there are plans for economic growth. Therefore, Romania/Ukraine can only meet its future Kyoto target, if action is taken towards energy efficiency. Furthermore, during the first commitment period Ukraine/Romania can benefit from the investments in energy efficiency measures from Western European countries, which need to reduce their CO<sub>2</sub> emissions using the Kyoto flexible mechanisms. This means that you calculate the CO<sub>2</sub> reductions from energy savings in the buildings, and the Western country which partly financed the energy savings can include the CO<sub>2</sub>-reduction in the fulfilling of their Kyoto-obligation. The payment for the CO<sub>2</sub> reductions will be part of the economy of the energy efficiency project - and gives an income to the homeowner association for many years.

Investment in energy efficiency at the end-user level, so that energy is not wasted, ought to be first priority for a more sustainable energy system. Next steps are to utilize energy from sustainable sources and to make energy production with fossil fuels more efficient.

A Joint Implementation project requires that the energy consumption is measured before the energy saving project starts, and afterwards is measured every year. Also it requires that the project is well described and has support from the municipality so that it will be approved by the state. This is a procedure that must be coordinated so that the paperwork does not have to be done from the start every time.

The unexploited energy saving potential has been estimated to at least 50-70% of the end-use energy consumption in Central and Eastern Europe, making the residential sector a focus area for energy saving measures. This will also have positive effects on social policy and employment.



## For further information

If you, your owners association, or your municipality want to do something in the field of energy efficiency in residential buildings, please contact:

**Ukrainian Network Energy Efficient Cities:** [www.munee.org](http://www.munee.org)

**Romanian Association for Energy Efficiency:** [www.socer.ro](http://www.socer.ro)

If you want more information on the procedure of Joint Implementation projects from Danish side please see: [www.danishcarbon.dk](http://www.danishcarbon.dk)

**Or contact the country coordinators directly by their e-mail address:**

**Romania:** Mr. Mihai Brasoveanu - E-mail: [depa@zappmobile.ro](mailto:depa@zappmobile.ro)

**Ukraine:** Mr. Vasyl Vasylychenko - E-mail: [vvv-kyiv@voliacable.com](mailto:vvv-kyiv@voliacable.com)

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