

ENERGY SAVING AT LOW OR NO COSTS

A HANDBOOK OF GOOD PRACTICE



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Wrocław University of Technology



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Ways to reduce consumption and costs of heat

In households the largest share in the structure of energy consumption are the needs for heating. In not thermo-modernized buildings they reach 70% of total energy consumption. Significant amounts of energy are also needed for water heating. The structure of the heat losses in the building are presented on the figure below. The biggest energy savings can be achieved by thermal modernization of buildings. They can be as high as 80%, however, require considerable funding (around 200 €/m²). Often a new high efficient boiler can reduce heating costs, but this measure also needs few thousand € investment. Low-investment activities or non-investment activities

related to changes in user habits can also contribute to a reduction in heat consumption. It is estimated that changing the habits of the users may allow heat savings of 15 - 30%.

On the following pages simple ways to reduce heat consumption and costs are presented. These will help you getting to know your energy consumption. Knowing when and where heat is needed, will help you reduce your consumption and costs. Notice: the savings influence each other and can't be summed up! Numbers are based on a 2-Person household with 14.000 kWh/a and 1.000 €/a heating costs.



The measurement of heat consumption (installation of heat meters)

Metering of heat consumption is a low budget way that can help to achieve considerable savings in energy consumption, and thus bring the effect in the financial and environmental benefits. The savings are caused by changes in the users habits and attention to energy losses due to the systematic control of the actual heat consumption. Metering and controlling can guide you to choose the appropriate measures. For instance, in which room to start. And it will help you to assess the effect of measures afterwards. If the situation in your house or flat is unclear for you, this would be a perfect starting point.

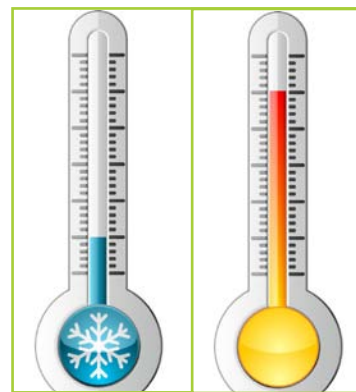


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Maintaining the proper thermal comfort (lowering temperature in rooms)

One of the main ways of saving energy for heating purposes is to maintain adequate thermal comfort in rooms. Thermal comfort is felt very subjective and depends on many factors, among others, age of the users and current activity. The aim should be to reduce the temperature in rooms to an acceptable level by subjective feelings of the user. Lowering the room temperature by just 1° C reduces heat consumption by about 5 - 9%. Lowering the temperature at night can bring savings of 5 - 15%. Care should be taken to not excessively reduce the room air temperature, as this can lead to moisture, mildew walls, and after a longer time to deterioration of the technical condition of the building. It is assumed that the optimal temperature in individual rooms should be: living room, children's room and kitchen - 20 ° C, bathroom - 22 ° C, bedrooms - 17 ° C. At night and during the absence in the household the room temperature can be reduced by a few degrees.

In the statistical household maintenance of an appropriate thermal comfort in rooms can result in savings of 70 to 120 €/a.



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Hydraulic balancing of the heating system

Hydraulic balancing is a method of optimizing the heating system with the result of reduction of energy consumption. This measure is recommended in the case a renovation of the building or if single rooms of the building have different temperatures caused by variety of pipe diameters and length and therefore different flow rates of the heat fluid. Rooms in a greater distance to the central heating plant are therefore not warm enough (i.e. in the attic), while others which are close to the boiler are hotter than needed.

A hydraulic balancing can ensure that the heat is optimally distributed. The valves will be adjusted in that way, that the drag in the system is balanced and hence warm water is equally distributed. This measure should be done by a specialist. Depending on your heating system, cost vary between 350 - 1.000 € with a payback time of 4-6 years.



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Optimisation of boiler settings

A lot of boilers work on standard settings. But every household is different. **Adjusting the settings to your personal behaviour can save energy (10% saving, ca. 100 €/a).** Consider making use of nighttime settings (lower temperature in rooms over night eg. 10 pm to 7 am). Maybe these standard times do not apply for you and you need warmth only in the evenings (eg. 7 pm to 11 pm). Especially when your boiler is not adjustable or you do not have a boiler please also refer to the possibility of electronically controlled thermostates (see page 5) these allow you to program settings for each heater/room.



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Rational use of hot water

Rational use of hot water benefits twice, reduce the consumption of water and energy required to heat it. Main methods to reduce water and energy consumption are:

- Use of faucet aerators for increasing the apparent volume of the water by suctioning the air into stream it can reduce water and heat consumption up to 15 - 50%.
- The use of a flow-through water heater close to the point of consumption helps to reduce heat losses during the transport of the hot water.
- A shower (50 l) can save up to 75% water and energy compared to a bath (200 l).
- Washing dishes in the dishwasher will reduce energy consumption by 50% and water by 60% compared to washing by hand.

In the statistical household implementation of the above described advices could save approximately 40-70 €/a.



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Proper air circulation around the radiator

The air is heated by circulating around the heater. It is important that it can freely propagate throughout the room. All kinds of pieces of household equipment such as curtains, furniture and others, interfere with air circulation. Make sure that the warmed air can freely flow from the heaters. If you keep heaters visible, you can have additional comfort from the thermal radiation from the heater. An important part of improving the efficiency of heating to assemble heat radiation screens behind heaters. These devices reflect up to 90% of the heat so that the heat does not warm the wall through which it penetrates outside the building. Following these guidelines may allow a reduction in heat consumption by about 5%.

In the statistical household use of this methods can afford to save about 35 €/a.



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Application of new seals for windows and doors

Air draught can not only make you feel uncomfortable in your apartment or house, but results also in heat loss. It can easily be stopped by exchange or renewal of seals on windows and doors. Seals from foam or rubber can be bought for few euros in Do-It-Yourself markets.



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Installation of valves with thermostatic heads

Installation of thermostatic heads enables the temperature controlling in every room, making it easier to get comfort in the apartment and at the same time it reduces the heat consumption by up to 20%. Most popular are the mechanical thermostatic heads, but better results are obtained after the application of electronic thermostatic heads that automatically change the room temperature depending on the destination and time of day. **In a statistical household savings that can be achieved are up to 150 € per year.** It should be remembered that this is a low-cost investment, and the energy savings can cover installation costs after about 2 years. It is further more possible to use a small device, which is placed on windows. It is connected to thermostates via radio. If the window is opened, the thermostate automatically shuts down the heater.

It is even possible to connect all thermostates via WLAN and to control the whole heating system via Smartphone or PC. Making it very easy to adjust room temperature, gain comfort and saving energy and costs. Investment costs for a household with 6 heaters are about 300-350 €.



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Insulation of heater recesses

Usually heaters were placed in recesses in order to have a plain wall. However this means, that the wall is often very thin, especially at the point where temperature and therefore heat loss is highest! If possible it is the best option to completely close the recess and place the heater in front. In case this is not possible, you can put an insulation panel behind the heater. It should be very strong material to achieve a high reduction of heat losses, since there is not so much space. Nowadays there are formable panels (see picture), which can easily be placed behind a heater.

At that point they can save up to 50% of the loss at that place (depending on the structure of the wall). Investment costs of around 25 € per m² will pay back soon.



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Further measures

- Insulate heating pipes - even in heated rooms!
- Ventilate room in bursts!
- Draw the curtains over night
- Reduce flow temperature in transition time
- Regular vent of heaters
- Install a high efficient circulator pump. It can save 80 % electricity (around 350 €, 2-4 years ROI)

Ways to reduce electricity consumption and costs

Electricity consumption in households is dependent on many factors. The most significant are: the number of users, their habits, social awareness, age and quality of the electric devices. Change of daily habits in electricity use can reduce the consumption of this form of energy from up to 25%.

Statistically, the highest demand for electricity has the fridge-freezer, oven, dish washer, drier and lighting. These sum up to over 60% of electricity consumption.

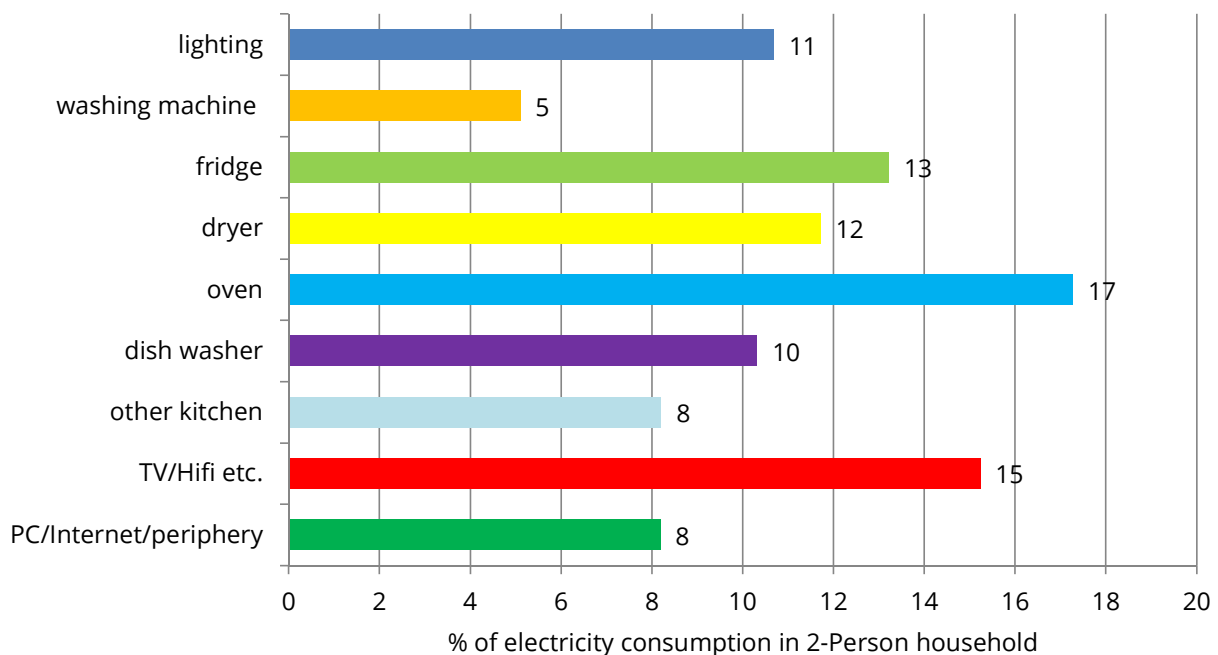
Reduction of energy consumption can be made through the exchange of used electric equip-

ment to newer, more energy efficient. Significant savings can also be achieved by changing the use of devices and own habits.

The technical solution is best for lighting, since LED technology saves over 80 % compared to common bulbs. But also a new fridge, oven or dishwasher can save substantial amounts of energy.

Assuming an average 2-person household, a common consumption is about 2.500 kWh per year. These distribute as shown below.

Calculated costs savings refer to european mean price for electricity 0,20 €/kWh, rounded.



Easy things you can do

The easiest things you can do to save energy are as follows:

- Take the chances of new stuff. If you need to buy new devices, be aware of their energy efficiency. Look for devices with very low or zero standby. A higher purchasing price can offer you more quality, the device might last longer and it can save a lot of energy and money in the long run.
- Switch off lights and devices whenever possible.
- Use lids, when cooking.
- Most devices use electricity although they are turned off (but still plugged in). Make use of switchable multiple sockets.
- Have a current measuring device to check and control your devices at home. It can be fun!

Fridge-freezer

Cooling and freezing equipment are devices that need to be connected 24 hours a day to the power supply. The result is statistically the largest electricity consumption of all devices used in households. **The best way to save energy used to power the refrigerator is replacement with a new one with a better energy class. It can give up to 70 % of savings.** It is connected, however, with considerable financial expense. Significant energy savings can also be achieved using simple non-investment methods. The most important are:



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- Setting the proper temperature. The optimum temperature of the refrigerator should be between 3 and 6 °C and the freezer from -18 to -15 °C. Such temperatures will protect food against lowering their quality, while also lowering power consumption. Lowering the products storage temperature below recommended does not affect in the increase in their quality, but significantly increases energy consumption (1 K is approximately 10% higher energy consumption).
- Frequent defrosting - frost thickness of 3 mm results in increased energy consumption by about 10%, 7 mm approximately 30%, 10 mm about 50%.
- Setting away from heat sources and out of direct sunlight - lowering the ambient temperature by 1 K helps to reduce the demand for energy to power the refrigerator for about 4%.
- Refrigerator condenser cannot be tightly covered and should be regularly (every few months) cleaned.
- When there is no adequate circulation of air around the condenser or the condenser is contaminated, the compressor has to work longer and thus consume more energy.
- Placing of products cooled to ambient temperature in a refrigerator.
- Hot products are warming the air in the refrigerator, thus the power consumption needed to drive the compressor is increasing - in the case of placing the hot product in the refrigerator compressor will consume three times more energy to cool it down.
- Product defrosting in the refrigerator.
- Frozen food put in the refrigerator is lowering the temperature inside chamber, it reduces the energy amount needed to drive the compressor.

All in all around 25% or 75 kWh can be saved this way.

Lighting

Lighting, which is the second largest share component of charges for electricity, is a good example of the possibility of obtaining very attractive effects resulting from the use of energy-efficient solutions. For energy-efficient light sources include compact fluorescent lamps (CFL), halogen bulbs and LED lighting. They consume much less energy than traditional light bulbs - **CFLs consume almost 5 times less power, and LEDs over eight times less energy than traditional light bulbs.**



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Changing to energy efficient lighting is related with certain costs, but payback is very quick. Assuming that the lighting is used for 4 hours per day, replacement of traditional light bulbs for compact fluorescent lamp will return after 5 months and LED lighting after 11 months. Not in all rooms compact fluorescent lamps should be used. CFL are good for rooms where lighting is used for a long time. In rooms where the light is switched on often for a short time traditional light bulbs or LED lighting should be used. Due to the mercury used in CFL, LEDs should gain priority. They also do not need time until they reach full illuminance.

In addition to investment methods aiming to provide energy savings, a savings can be achieved by changing the way of use. Such methods include:

- use of natural light as much as possible,
- painting of walls and ceilings in the bright colors - white wall reflects 80% of light,
- switching off lights in rooms in which people are not present,
- systematic cleaning of lighting fixtures - dust can absorb up to 60% of the light.

Saving oriented using can save around 20 %. Replacement of bulbs in the reference household brings up to 200 kWh/a (ca. 40 €).

Cookers and ovens

When preparing meals, up to 40 % (165 kWh) can be saved. Energy savings and its level depend on the selection of appropriate devices and user behavior. The most important are:

- products should not be defrost in the ovens, it is best to do it in the refrigerator, so it does not consume energy to power ovens and reduces the energy consumption of the refrigerator,
- using of lids for pots may result in 15 - 40% energy saving,
- water should be first boiled in the electric kettle, then pour into the pot - kettle has a higher efficiency than cookers and such treatment may allow for 30-50% energy savings,
- the power of the oven can be turned off 5 - 10 minutes before the end of cooking, the temperature will remain the same, which will finish the cooking process without electricity consumption,
- using of hot air function allows to save up to 20% of energy,
- unreasonable opening of the oven door can increase energy consumption by about 10%.



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Washing machines

A significant amount of energy can be saved by the right usage of washing machines (up to 50% or 57 kWh in the reference household).

- washing should be done at full capacity,
- regardless of the degree of loading the washing machine energy and water consumption will be the same,
- if possible, the temperature of the wash should be reduced,
- washing machine savings programs allow to reduce energy consumption by up to 40%,
- good solution is to supply the washing machine with warm water - usually water is heated using energy carrier at a lower cost than electricity by which water is heated in a washing machine.



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Dishwashers

Dishwashers are the devices that allow to simultaneously save energy, water and time needed to wash dishes. **Washing dishes in the dishwasher helps to reduce energy consumption by 50% and water by 60% compared to washing up by hand.**

In addition, it should be remembered that:

- The dishwasher should be run when it is full.
- Regardless of the degree of loading of the dishwasher water and energy consumption will be the same.
- If possible use economic programs - with a low degree of soiling dishes can be washed at lower temperatures.
- A good idea is to power the dishwasher with hot water - usually water is heated using energy carrier at a lower cost than electricity by which water is heated in the dishwasher.

Thrifty use of the dishwasher can save 25 % (ca. 60 kWh/a).



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Stand-by / Energy saving mode

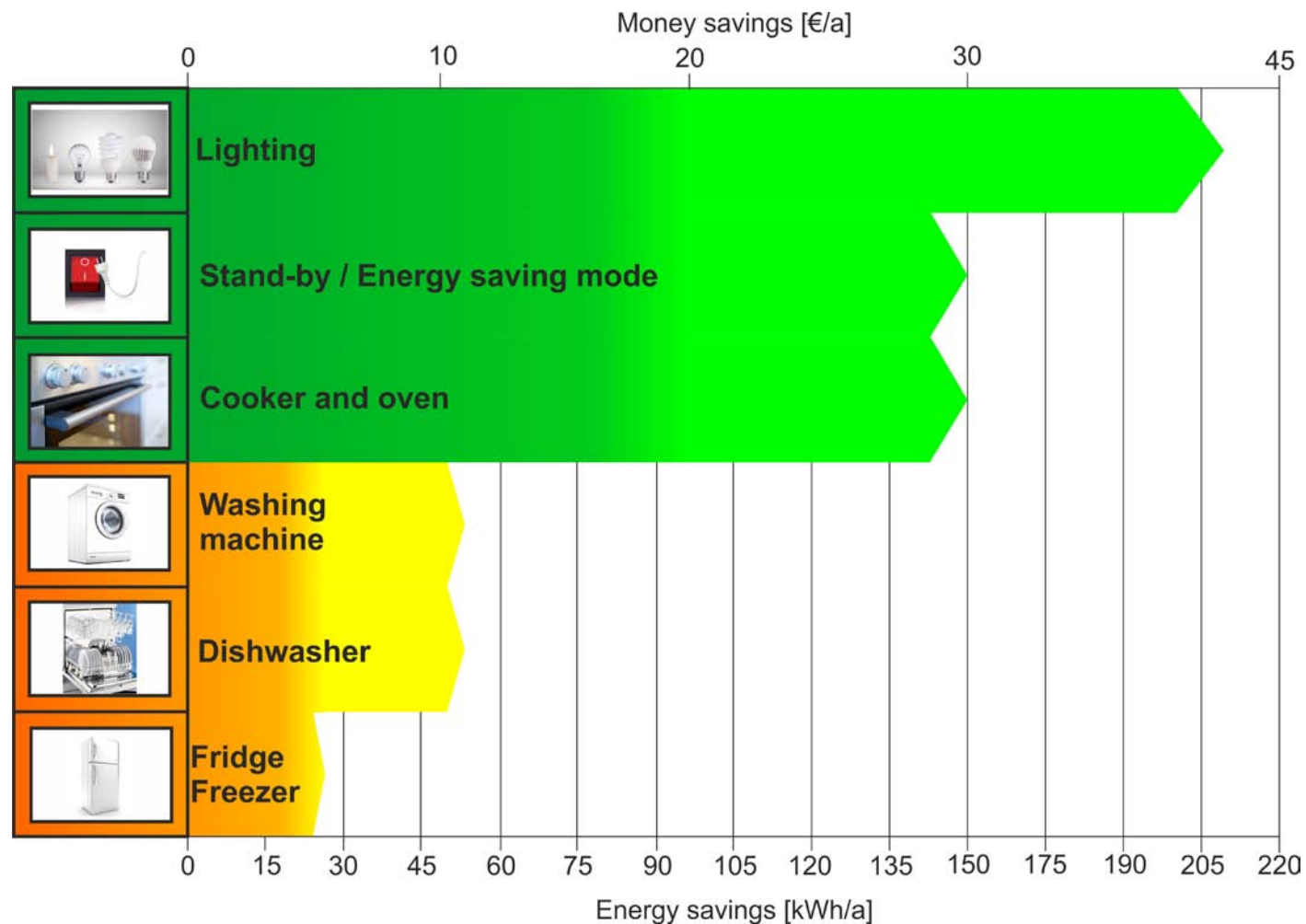
Most electronic devices and computers (i.e. TVs, home theater systems, computers, routers, etc.) have a stand-by mode. It may be very useful, but while in stand-by devices still consume energy. Stand-by power demands are not large, but they sum up to a significant amount through the year. **The total stand-by energy consumption of all devices (coffee machine, TV, router, PC, charger, HiFi, etc.) sums up to about 150 kWh or 30 €.**

For other devices as computers: use powersave mode or shut down in breaks.



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Overview and Classification of the measures - electricity

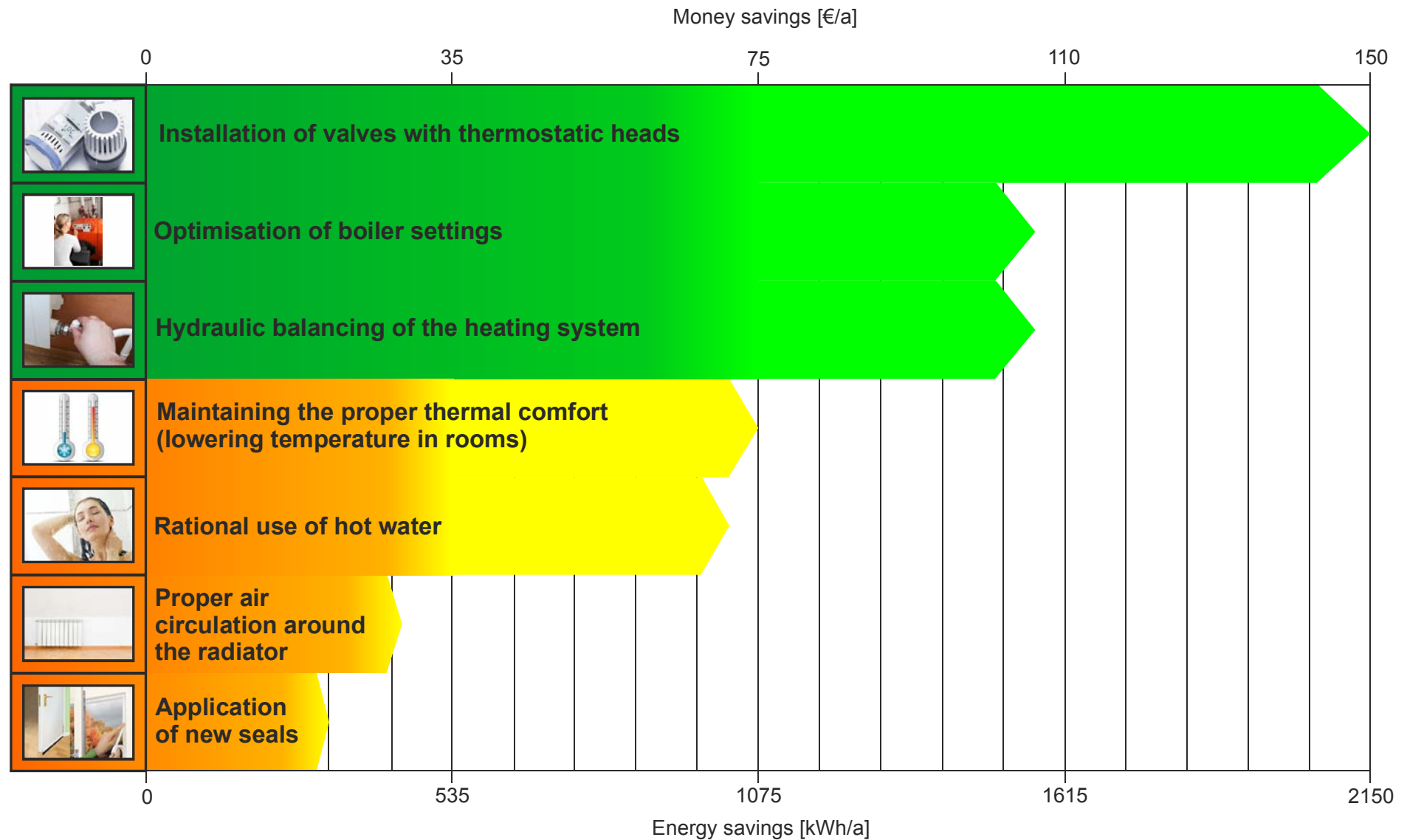


Displayed in this overview of some of the measures showed on the previous pages. The measures are classified. Green measures are highly recommended due to their high saving potential. Measures with lower saving potential are shown in yellow. The light colours indicate ranges of possible saving, since the actual saving heavily depends on the specific situation.

Please notice: the saving of the heat measure overlap, therefore you cannot simply sum up the potentials of the single measures!

Money savings are calculated with 20 ct/kWh electricity and 7 ct/kWh heat.

Overview and Classification of the measures - heat



About ENERGYREGION

ENERGYREGION - *Effective development of dispersed renewable energy in combination with conventional energy in Regions* is an EU funded project implemented through the CENTRAL EUROPE Programme and co-financed by the European Regional Development Fund. The project started on the 1st of October 2011 and will last for three years, until the end of September 2014. ENERGYREGION Project is realized by eleven teams from four European countries (Poland, Czech Republic, Slovenia and Germany).

The main goal of the project is to create a strategy of sustainable development of renewable energy sources. Energy market is a huge challenge for contemporary countries. Access to reliable and reasonably-priced energy is what national and local authorities responsible for the energy sector are currently concerned about. In the view of

tightening environmental regulations, renewable energy technologies are becoming more competitive. In order to fulfill more and more strict regulations in the area of environment protection and energy generation the ENERGYREGION Project will aspire to create initiatives promoting renewable energy and increasing social awareness. It will aim to develop regional strategies to enhance investments in energy infrastructure. Moreover, it will try to reveal hidden potential for energy savings in different regions.

International cooperation will help to share information on renewable energy sources and energy efficiency. It will enable exchange of know how and the best practices. Learning from those who are more advanced will be the best way to avoid mistakes in the area of renewable energy increase and energy efficiency improvement.

For more information on measures please have a look at the full version of this hand book and the catalogue of measures on the project website.

<http://www.energy-region.eu>

<http://www.central2013.eu>

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