



# EffCoBuild

## ENERGY EFFICIENCY COMMUNITIES – ESTABLISHING PILOT COMMUNITIES FOR THE BUILDING SECTOR

**WP6 – REPORT ON PILOT PROJECT  
“ENERGY SAVINGS IN EXISTING SUPPLY SYSTEMS”  
WITH ELECTRONIC CONTROLLABLE THERMOSTATIC VALVES**

**IMPLEMENTED IN THE COMMUNITIES:**

**WITTSTOCK – GERMANY  
BERLIN – GERMANY**



supported by:

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## TABLE OF CONTENTS

<b>1. Summary .....</b>	<b>3</b>
<b>2. Background.....</b>	<b>4</b>
<b>3. Objective of the Field Test.....</b>	<b>5</b>
<b>4. General Procedure .....</b>	<b>6</b>
4.1. Involvement of Partners .....	6
4.2. Implementation.....	6
4.3. Evaluation.....	6
<b>5. Implemented Technology .....</b>	<b>7</b>
5.1. Thermostatic Valves – Central Control Unit.....	7
5.2. Thermostatic Valves – Decentral Control Unit.....	8
<b>6. Project Activities .....</b>	<b>9</b>
6.1. Involvement of Partners .....	9
6.1.1. <i>Involvement of Energy Suppliers.....</i>	<i>10</i>
6.1.2. <i>Involvement of Valve Manufacturers .....</i>	<i>10</i>
6.1.3. <i>Involvement of Housing Associations.....</i>	<i>10</i>
6.2. Implementation.....	10
6.3. Evaluation.....	11
6.4. Overview of Procedure.....	12
<b>7. Documentation and Evaluation of the Consumption data and energy savings .....</b>	<b>13</b>
7.1. GWV Wittstock .....	13
<b>8. Documentation and Evaluation of the Surveys.....</b>	<b>15</b>
8.1. Overview of the Surveys .....	15
8.2. Household Survey .....	15
8.2.1. <i>General Questions.....</i>	<i>16</i>
8.2.2. <i>Field Test.....</i>	<i>18</i>
8.2.3. <i>Heating and Ventilation Behavior .....</i>	<i>20</i>
8.3. Second Household Survey.....	28
8.4. Craftsmen Survey after Implementation of Valves .....	32
8.5. Survey of the Housing Associations .....	38
<b>9. Annexes.....</b>	<b>40</b>
9.1. Overview installed valves.....	40
9.2. Household Survey .....	42
9.3. 2 <sup>nd</sup> Household Survey .....	45
9.4. Survey Technicians.....	46
9.5. Survey Building Companies .....	48

## 1. SUMMARY

The intention of the field test was to evaluate the cost-efficient reduction of heat energy consumption in existing buildings by installing electronic controllable thermostatic valves. The valves promise energy savings of 10 – 25% for relatively low investment prices. For this reason 388 thermostatic devices (for 355 radiators) were installed and the corresponding consumption data collected for two years in Wittstock and one year in Berlin. Additionally the handling and acceptance by tenants was evaluated. The tenants were informed about the project and the technology and were asked to fill out a questionnaire before the installation and after the first heating period.

Most of the tenants of the participating households already tried to save electrical energy at home and were aware of the means to save energy. Still some tenants showed antipathy against the new technology – especially older people objected the electronic devices. It has become obvious that the acceptance and the willingness of tenants to take part in a technical field test depend on the voluntary character of the project. The differences in results between Wittstock and Berlin make this clear.

The tenants were well informed by the housing company and introduced to the technology by the craftsmen. As a result no bigger problems occurred with the handling (7 – 25%). Although the expectation to save heat energy is only 44 – 70 % most of the tenants find the usage of the devices suitable for everyday use. Also a feeling of higher comfort is a result of the thermostatic valves. It can be concluded that especially younger or mid-aged families are very satisfied with the handling, the higher comfort and the possibility to lower their energy costs.

The result of the energy savings until now is not very representative. Only the data of GWV Wittstock could be used for the evaluation. In these two buildings small energy savings of 6.5% and 10.5% could be achieved. However, these numbers do not necessarily represent the potentially achievable savings. The evaluation of at least one more accounting period in Wittstock as well as evaluations of the data of Berlin would be essential for a well-founded statement.

## 2. BACKGROUND

Global greenhouse gas emissions have to be reduced drastically within the next years in order to prevent the most serious effects of global warming. In its fourth assessment report the Intergovernmental Panel on Climate Change (IPCC) identified the building sector as one with very high saving potentials. According to the report, considerable reductions in CO<sub>2</sub> within the building sector can be achieved by changes in occupant behaviour, consumer choice and the use of new technologies.

While energy costs are constantly increasing, a large share of buildings is still in need of partial or complete renovation. Since the housing market is a tenant's market, the housing associations have to make sure they provide apartments at suitable prices. One possibility is to keep the utilities as low as possible in which heating costs have the biggest share by far. That is why the housing associations try to find ways to save energy with none or low costs.

Electronic controllable thermostatic valves could fit into this strategy. Manufacturers claim heat energy saving rates up to 15 % for single controllable valves adapted to each radiator of an apartment and up to 25 % if a controllable central unit is used which controls the different valves. The devices are at costs between 300 – 400 Euro for decentral or 500 – 600 Euro for central solutions. A contribution to climate protection and low utility costs could be achieved at rather low investment costs.

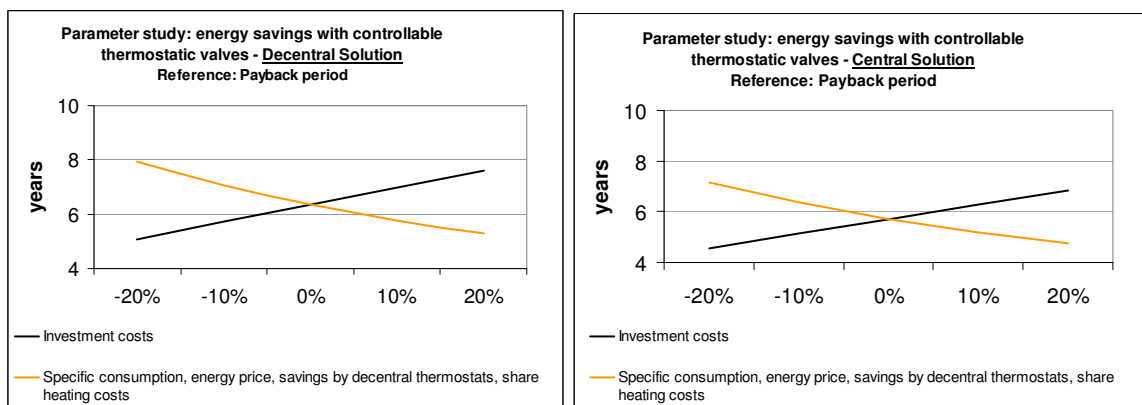
### 3. OBJECTIVE OF THE FIELD TEST

The main objective of the field test named "Energy savings in existing supply systems" was to prove the reduction of heat energy consumption in central heated multi-family houses by using electronic controllable thermostatic valves for heat radiators.

The manufacturers of thermostatic valves claim heat energy savings of 10 to 25 %. The field test aimed to take this statement into a practical test. Additionally, the applicability of thermostatic devices in households was analysed. It includes the handling of two different thermostatic devices (see chapter 5) and the acceptance of the tenants.

The potential energy savings would mean payback periods of about 6 years. The following figures show that the payback periods depend on several parameters. The graphs show that several parameters have an equal effect upon the mean value.

**Figure 1: Payback period for decentral and central solution**



The relation between them can be described as

$$\text{payback period} = \text{investment costs} / \text{saved energy costs per year}$$

The saved energy costs result from

$$\text{living space} \times \text{specific consumption} \times \text{energy saving rate} \times \text{distribution key of heating costs} \times \text{specific energy costs}$$

It becomes evident by the formula that all factors have the same weight or influence. With the chosen reasonable approach it becomes evident that the payback period must be between 4 -8 years and that the central solution is favourable.

## 4. GENERAL PROCEDURE

This chapter gives an overview of the different activities of the field test. The detailed description of the phases of the project follows in chapter 6.

### 4.1. Involvement of Partners

The manufacturers were interested in the results of the project. They offered their devices for lower prices than regular. Nevertheless, to involve housing associations the costs for a field test still seemed too high. For this reason local energy suppliers were asked to support the project and, hence, provided an additional service to their important clients.

With the beginning of the project several actors were identified and had to be involved in the project:

- energy suppliers
- manufacturers of thermostatic valves
- housing associations

### 4.2. Implementation

The installation of the thermostatic valves was scheduled before the beginning of the heating season 2006/2007. For the field test the technology should be tested for two heating periods. Before and during the implementation phase the tenants had to be informed about the technology and the handling of the electronic control of the valves.

### 4.3. Evaluation

To evaluate the project several steps were planned. On the one hand the heat energy savings should be evaluated based on the consumption data of the participating households. On the other hand the acceptance and handling of the tenants should be analysed in form of interviews and questionnaires.

The consumption data of the buildings had to be supplied by the housing associations for the two heating periods.

A questionnaire was sent to the tenants before the installation of the thermostatic valves and another one after the first heating period. Additionally, the implementing craftsmen had to fill out a questionnaire and the housing associations were interviewed by telephone.

## 5. IMPLEMENTED TECHNOLOGY

Two different systems were implemented in the participating households. One is a control unit which regulates the temperatures of all heat radiators from one central device. In the other system every heat radiator is equipped with a thermostat and can individually be adjusted.

### 5.1. Thermostatic Valves – Central Control Unit

Controllable thermostatic valves are radio-controlled by a central electronic control unit. These systems consist of one central control unit and one electronically controlled thermostat for each heat radiator. The programming of all thermostats is managed by the central control unit only. The information is sent by radio-waves to the thermostats. Every room or defined zone can be adjusted to the personal comfort.



*Honeywell HR80 and CM Zone*

#### Advantages:

- Easy control of all devices
- Several adjustable programmes
- Information is sent by radio-waves → no cables needed

#### Disadvantages:

- Higher investment costs
- The devices are run by batteries with a lifetime around two years → thus they produce maintenance costs for the tenants;

The manufacturers state a possible heat energy reduction of 10-25 % for a central radio-controlled electronic thermostatic valve. The installation of a central control module will cause cost of about 500-600 €. Its implementation is sensible in big apartments with many controllable rooms

## 5.2. Thermostatic Valves – Decentral Control Unit

Thermostatic valves with decentral electronic control units are systems that consist of one electronically controlled thermostat per heat radiator. The programming is carried out directly at the thermostat respectively. Each thermostat can be programmed individually.



*Honeywell HR40*



*Heimeier E-Pro*

### Advantages:

- Easy installation by attaching on top of existing valves;
- Low investment costs;
- Several adjustable programmes;
- Manual adjustments at any time;
- Easy handling for all users;

### Disadvantages:

- The devices are run by batteries with a lifetime around two years → thus they produce maintenance costs for the tenants;
- No central control unit in the hall – no easy system switch off;
- Problems for adjusting the programmes;
- Noise development.

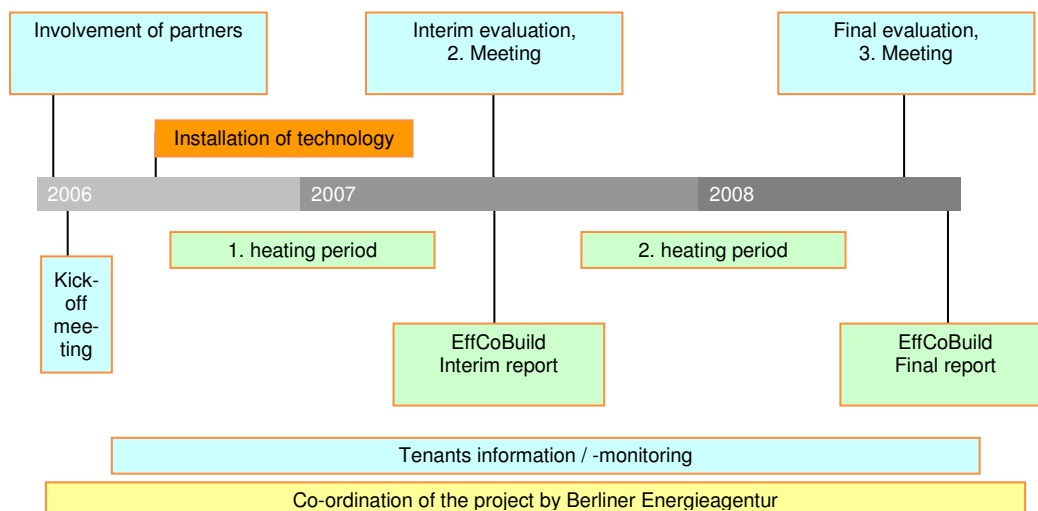
The manufacturers state a possible heat energy reduction of 10-15 % for a single controllable electronic thermostatic valve. Each electronic valve costs about 70-80 €. For a three-room apartment investment cost of at least 250-350 € will occur. Therefore it should be well considered, which radiator is to be equipped with the valves to keep the equipment costs on an economically justifiable level.

## 6. PROJECT ACTIVITIES

The field study was divided into three performance periods. The first period embraced the involvement of the project partners (energy suppliers, manufactures, and housing associations). In the second phase the described technology was installed in the participating households. Additionally, several interviews were carried out with the tenants, the technicians, and the household associations. In the third and last phase, the energy consumption and the results of the interviews were evaluated.

Figure 2 shows the project development plan which was implemented in Wittstock. For Berlin the schedule was delayed.

**Figure 2: Project development plan – implemented in Wittstock**



### 6.1. Involvement of Partners

While the involvement of energy suppliers as financial supporters and valves manufacturers as product suppliers was rather easy and quick, the gain of housing associations was much more difficult and time consuming.

The manufacturers and the energy suppliers provided the appropriate technology and supported the project financially. The housing association searched and selected suitable buildings, which means: central supplied, heating energy consumption higher than 150 kWh/m<sup>2</sup>a, thermal insulation of the building envelope not planned in short or middle term, data of heat energy consumption of the past three years are available. The reason of the recommended high consumption was the better pay-back period because of higher absolute energy saving amounts. Moreover the manufacturers should appreciate that the tenants are 'ready' for this kind of technology.

This period ended with the arrangement of co-operation agreements between the Berliner Energieagentur (BEA) and the participating project partners as listed in the following subchapters.

### **6.1.1. Involvement of Energy Suppliers**

The following energy suppliers supported the field test with 30 % of the investment costs and, additionally, with a financial support for the work of the BEA:

- GASAG AG
- Erdgas Mark Brandenburg GmbH (EMB) – supported the GWV Wittstock

### **6.1.2. Involvement of Valve Manufacturers**

The manufactures offered a reduced the purchasing price for the valves up to 50 % to let their statements about possible savings be surveyed by an independent organisation. Additionally, the manufactures were highly interested in the results of the independent field test with housing associations being also a key customer group. The following manufactures supported the field test:

- Honeywell GmbH, Haustechnik
- Theodor Heimeier Metallwerk GmbH
- Danfoss GmbH

However, only products of the first two manufacturers were chosen by the housing associations (see chapter 5).

### **6.1.3. Involvement of Housing Associations**

To carry out a well-founded field test, it was necessary to involve different housing associations. Due to the existing potential of heat energy reduction in buildings, the field test offered a possibility for testing electronic controllable thermostatic valves regarding the energy consumption reduction as well as the feasibility in practice. The following housing associations were involved in the project:

- Gebäude- und Wohnungsverwaltung GmbH, Rheinsberger Str. 28, 16909 Wittstock
- Wohnungsgenossenschaft "Weissensee" e. G., Berliner Allee 231, 13088 Berlin
- WGB Treptow Nord, Kieffholzstr. 289, 12437 Berlin
- Charlottenburger Baugenossenschaft eG, Dresselstraße 1, 14057 Berlin

## **6.2. Implementation**

The procurement and the implementation of the field test were organized by the BEA. Therefore the participating housing associations supplied the BEA with the correct number of radiators and type of required components. Based on this information the BEA negotiated the prices for the relevant components with the manufactures directly. Due to the relevance of the field test the BEA was able to negotiate a price of 40 to 50 % below the actual market price. An additional cost reduction was possible to achieve due to the financial support of the energy suppliers GASAG and EMB.

The kick-off-meeting and the first installation of the valves took place in Wittstock (2006). The following table shows the number and type of technology installed in the different buildings:

**Table 1: Installed technology**

	Central units		Decentral units	
	Honeywell CM Zone	Honeywell HR 80	Honeywell HR 40	Heimeier E-Pro
Wittstock	12	60	60	
WG Weissensee			57	47
WG Treptow	11	56		
Charlottenburg	10	75		

The prearrangement and the final installation of the valves were intensively accompanied by information and monitoring activities. This included e.g. information meetings and information material for instructing the tenants already before the installation. The BEA prepared information material in cooperation with the housing associations. This information was handed out to the participating households.

A list of the participating households and the number of devices installed can be found in Annex 9.1.

### 6.3. Evaluation

At the end of the evaluation period the tenants of the housing association GWV Wittstock experienced two heating periods since 2006. The tenants of the housing associations Weissensee eG and Treptow Nord eG experienced one heating period (since 2007).

Because of the delayed start only for Wittstock consumption data were available for one year after the implementation. For WG Weissensee the accounting company was commissioned to execute a midway reading for the period 01.01. – 30.06.2008. Nevertheless, the data has not arrived yet and therefore cannot be evaluated.

For a qualified evaluation of the field test the BEA prepared a survey which was addressed to the tenants before the start of the heating period. A second survey took place after the heating period in 2008 to evaluate the instruction and installation procedures. Additionally, a third survey was developed which addressed the technicians. A final telephone survey with the housing associations was carried out in June 2008. Chapter 7 is the evaluation of these questionnaires and interviews.

## 6.4. Overview of Procedure

- |                |  |
|----------------|--|
| June 2006      | <ul style="list-style-type: none"> <li>• 1<sup>st</sup> working meeting at the BEA</li> <li>• Request to different manufactures for a first cost estimation</li> <li>• Start of the information activities to collect inventory data of the participating housing associations</li> <li>• Coordination of the tenants information</li> </ul>   |
| July 2006      | <ul style="list-style-type: none"> <li>• 2<sup>nd</sup> working meeting for the manufacturer selection (incl. presentation of products, cost planning, test set-up at the BEA)</li> <li>• Conclusion of co-operation agreement with the housing association of Wittstock</li> <li>• Information of the participating tenants. The BEA provided an information flyer</li> <li>• The housing associations finished the evaluation of their inventory data. The data was the base for the deliveries by the manufactures</li> <li>• The manufactures defined and prepared the delivery of the devices. Contractual agreements with the manufacturer followed</li> <li>• The manufacturer delivered the valves. The BEA co-ordinated the process</li> <li>• The BEA developed a tenant survey – concerning the consumption behaviour – and a survey which addressed the technicians. The surveys were distributed by the housing associations</li> </ul> |
| August 2006    | <ul style="list-style-type: none"> <li>• Installation of the electronic controllable thermostatic valves in Wittstock</li> <li>• Technicians exchanged the old valves and/or installed the central control units</li> <li>• The technicians answered the survey. The surveys were collected</li> <li>• The technicians handed over the survey to the tenants. Afterwards the surveys were collected and sent back to the BEA</li> </ul>  |
| September 2006 | <ul style="list-style-type: none"> <li>• The field test started with the heating period</li> </ul>   |
| Until May 2007 | <ul style="list-style-type: none"> <li>• Intensive search and attraction of housing associations in Berlin</li> <li>• Negotiations and development of cooperation agreements</li> </ul>  |
| July 2007      | <ul style="list-style-type: none"> <li>• Ordering of the components for the Berlin housing associations</li> </ul>   |
| September 2007 | <ul style="list-style-type: none"> <li>• Implementation in Berlin</li> </ul>   |
| May 2008       | <ul style="list-style-type: none"> <li>• 3<sup>rd</sup> working meeting for a first project evaluation at the BEA</li> <li>• Development of a second tenant survey regarding the heating behaviour and the experience with the new valves after two heating periods (only Wittstock)</li> <li>• Compilation of the latest consumption data by the housing associations</li> <li>• Evaluation of the field test results by the BEA</li> </ul>   |
| July 2008      | <ul style="list-style-type: none"> <li>• Report of the field test results by the BEA</li> <li>• The participated tenants will receive an report on the project results</li> <li>• Utilization of the project results for further projects and publications</li> </ul>  |

## 7. DOCUMENTATION AND EVALUATION OF THE CONSUMPTION DATA AND ENERGY SAVINGS

Although the BEA commissioned the housing associations to read the consumption data of the participating buildings, only the data for GWV Wittstock has been delivered in time. Due to the delay of the implementations in Berlin it seems reasonable to evaluate data from Wittstock in the first place. Thus, only results and statements for the two buildings of GWV Wittstock can be made.

### 7.1. GWV Wittstock

Figure 3 and 4 show the heat energy consumption of Röbeler Str. 6-8 and Röbeler Str. 15-17 in the years 2003 to 2007. The first three years are the reference years. The years 2006 and 2007 represent the years with the electronic controllable thermostatic valves installed. The valves were installed in August 2006, so it has to be considered that the valves were only in usage during the second half of the year. In 2007 the thermostatic valves were in use for the complete heating period. In Röbeler Str. 6-8 central control units and in Röbeler Str. 15-17 decentral control units were installed.

**Figure 3: Heat energy consumption of Röbeler Str. 6-8 (2003-2007)**

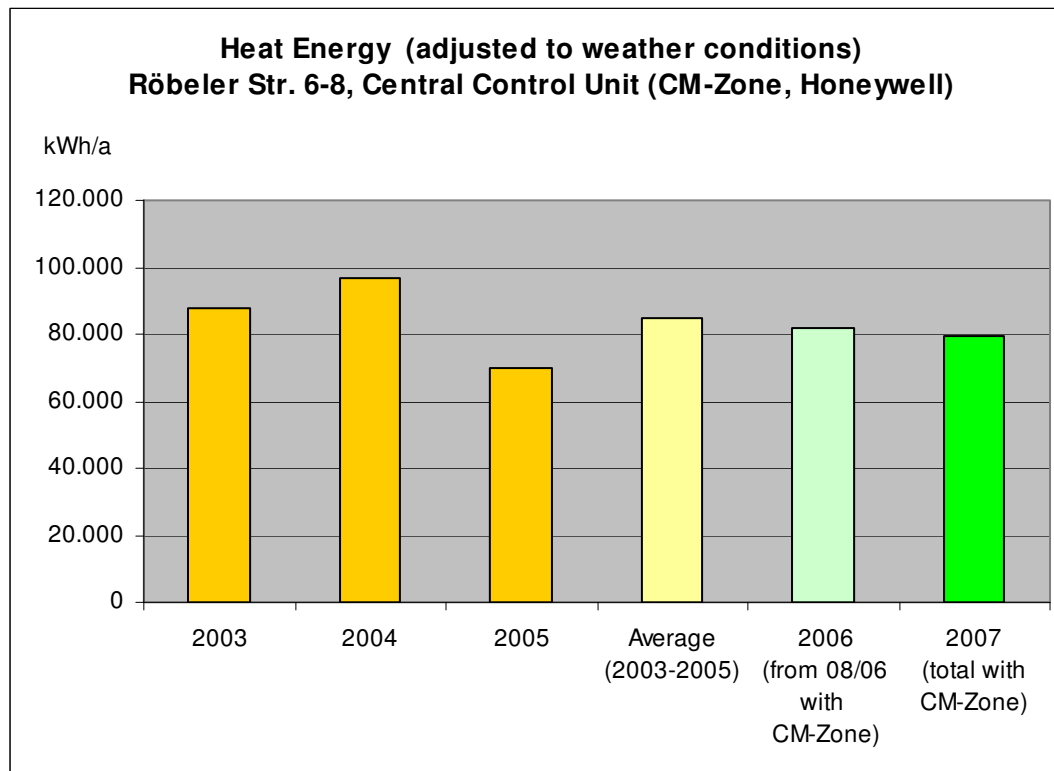


Figure 3 above shows that minimal energy savings could be achieved compared to the average of the last three years. According to the consumption data 3.9% of heat energy could be saved in 2006 and 6.5% in 2007. These shares correspond to savings of 3,341 kWh and 5,483 kWh respectively. It becomes obvious that these results are less than the assumed 10 to 25%.

However, the figure also shows that the consumption data of the previous three years have high fluctuations. The consumption in 2005 is 38% less than in 2004. As a result the heat energy consumption in 2006 is higher with the installed devices than in the year before. A reason for this high energy decrease could not be given by GWV Wittstock. According to the person in charge, no energy saving measures have been carried out.

**Figure 4: Heat energy consumption of Röbeler Str. 15-17 (2003-2007)**

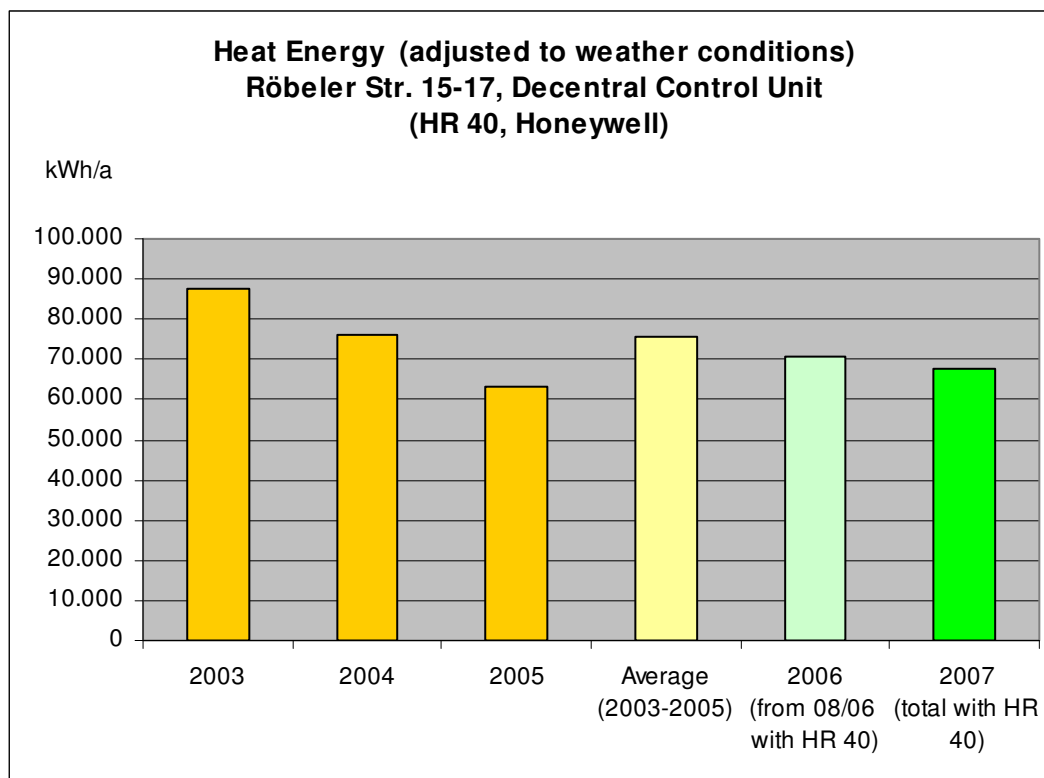


Figure 4 shows slightly better results than Figure 3. In Röbeler Str. 15-17 more than 10% heat energy savings could be achieved. In 2006 a reduction of 6.7% (5,100 kWh) compared to the average was possible. In 2007, a complete accounting year with the new technology, 10.5% (7,915 kWh) could be saved.

Nevertheless, also in this building the heat energy consumption in 2007 is 7.2% higher than in the year before the installation. The consumption has continuously decreased in the years 2003 to 2005. A reason for this high energy decrease could also not be given for this building by GWV Wittstock. Also in this building no energy saving measures have been carried out.

## 8. DOCUMENTATION AND EVALUATION OF THE SURVEYS

The project has been supervised by four different surveys. In the following chapters the evaluation of the field test will be presented:

- 1<sup>st</sup> interviews of participating households by a standardised survey;
- Interviews of participating technicians by a standardised survey;
- 2<sup>nd</sup> interviews of households at the appointed day of the evaluation;
- Telephone-based interviews of the participating housing associations.

### 8.1. Overview of the Surveys

The housing associations arranged a number of participating households. However, even the carefully carried out information activities by the BEA as well as the technical instruction by the technicians could not prevent that certain tenants arranged a removal of the new valves.

**Table 2: Number of participants of the surveys\***

	1. household survey	in %	2. household survey	in %	Craftsman survey	in %	Housing association survey
GWV Wittstock	18	38 %	18	41 %	12	29 %	1
Weissensee eG	20	43 %	16	36 %	20	49 %	1
Treptow Nord eG	9	19 %	10	23 %	9	22 %	1
Charlottenburger eG	-		-		-		-
<b>in total</b>	<b>47</b>	<b>100 %</b>	<b>44</b>	<b>100 %</b>	<b>41</b>	<b>100 %</b>	

\* Please note that not all of the questionnaires have been filled out by the tenants and technicians. Therefore the available questionnaires do not necessarily represent the opinion of all tenants.

Especially GWV Wittstock and Weissensee eG had a very active role. The Charlottenburger eG was not very cooperative and did not send back any questionnaires. Hence, no information of Charlottenburg could be used for the surveys.

### 8.2. Household Survey

The interviews of the households have been conducted subsequently to the installation of the new valves. The survey includes the evaluation of the knowledge, attitude and behaviour towards energy saving measures by the tenants. This survey functions as a base for carrying out the 2<sup>nd</sup> household survey and for the evaluation of further consultancies.

The results of the surveys are analysed by the amount of surveys which have been carried out by each building company. Further scientific analyses are not planned. Nevertheless, the results can be used for further evaluations e. g. when continuing the field test. The questionnaires of the surveys are attached in the annex of this report.

### 8.2.1. General Questions

Question 1: How many people, in which age, live in your household?

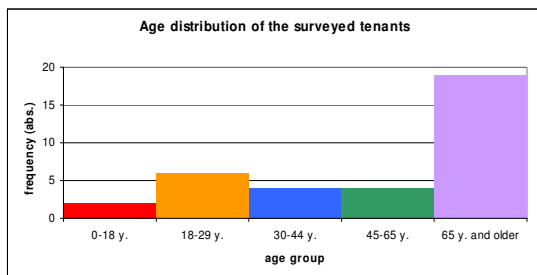


Chart 1: GWV Wittstock

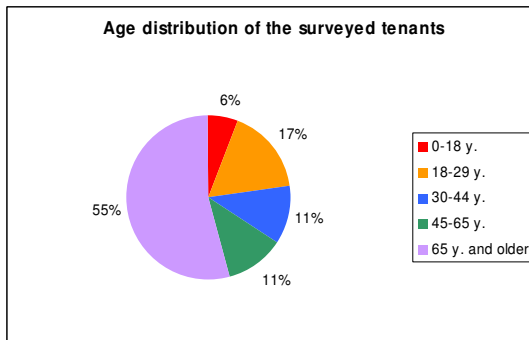


Chart 2: GWV Wittstock

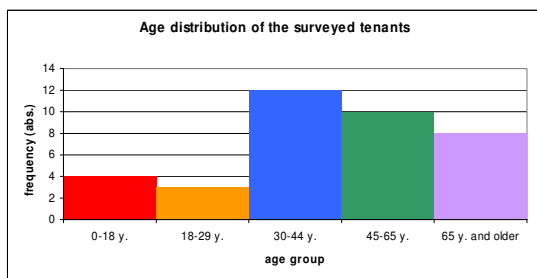


Chart 3: Weissensee eG

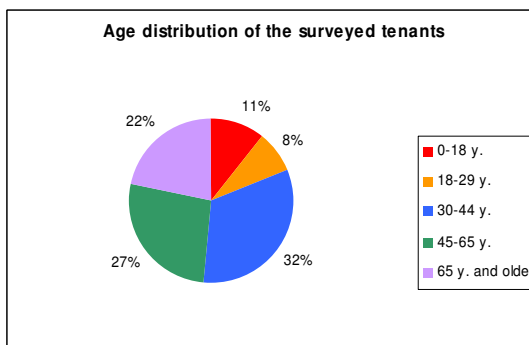


Chart 4: Weissensee eG

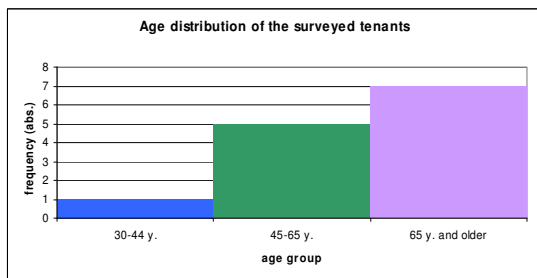


Chart 5: Treptow Nord eG

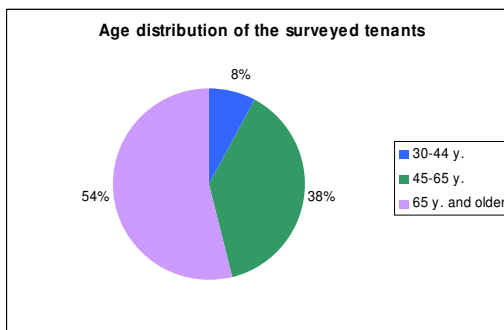


Chart 6: Treptow Nord eG

The analyses of the categories show that the age distribution of the tenants differs strongly between the participating housing associations. The most diversified age distribution can be identified for the housing association Weissensee eG. In the households of Treptow Nord eG and GWV Wittstock a share of more than 50 % of the participating tenants are 65 years and older. Especially the participating tenants of Treptow Nord eG are strongly dominated by seniors between 45-65 and 65 years and older.

**Question 2: How many hours per day no one is in your flat, while the temperature can be lowered?**

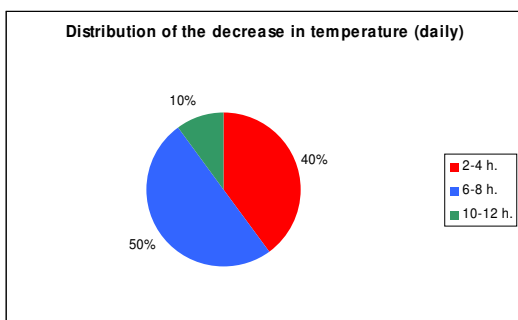


Chart 7: GWV Wittstock

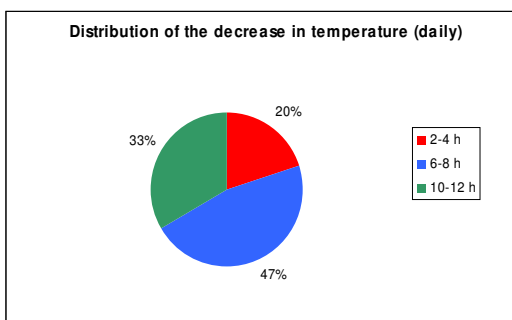


Chart 8: Weissensee eG

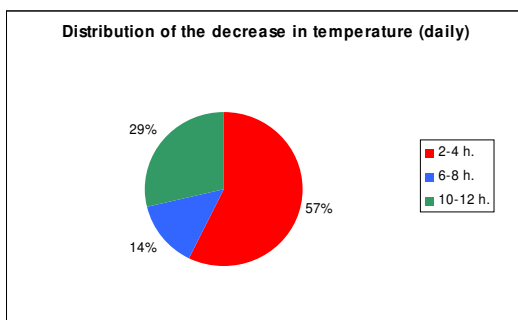


Chart 9: Treptow Nord eG

The age distribution of the participated tenants of the housing associations correlates with the number of hours per day when no one is present in the flat. It becomes obvious that the older the tenants are the more hours they spend at home (compare to chart 7 and 9). The distributions of the numbers of hours spend out of home illustrates that younger tenants within the age category 0-18, 18-29 and 30-44 years old generally spend more time out of the flat as older person do.

**Question 3: Do you know the average energy consumption level (kWh/m<sup>2</sup>) of your building?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	6 %	0 %	0 %	
"no"	94 %	100 %	100 %	
Error ratio	1	0	0	

**Question 4: Do you pay attention to the energy consumption level of electronic devices?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	94 %	90 %	100 %	
"no"	6 %	10 %	0 %	
Error ratio	0	0	0	

**Question 5: Does any electronic device run for a longer time in stand-by modus?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	13 %	40 %	33 %	
"no"	88 %	60 %	67 %	
Error ratio	2	0	0	

Question 3 shows that almost no tenant has an overview of the average energy consumption of the building. Energy consumption has, obviously, not been a decisive factor for the apartment. However, most of the tenants have a high consciousness for their private energy consumption and pay attention to consumption levels of electronic devices. More than half of them turn-off electronic devices with stand-by modus.

**Question 6: Do you use a switchable multiple socket?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	53 %	80 %	89 %	
"no"	47 %	20 %	11 %	
Error ratio	1	0	0	

**Question 7: Do you own multiple sockets with time switch?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	6 %	25 %	11 %	
"no"	94 %	75 %	89 %	
Error ratio	2	0	0	

**Question 8: Do you own a video recorder and are you able to operate the device?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	50 %	75 %	56 %	
"no"	50 %	25 %	44 %	
Error ratio	2	0	0	

The questions 6 and 7 show that low investment energy saving devices are used in most households. Between 50 and 75 per cent of the tenants have a programmable electronic device at home and are able to operate it.

**8.2.2. Field Test****Question 9: Did you understand the instruction by the technician of the electronic valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	72 %	100 %	100 %	
"no"	28 %	0 %	0 %	
Error ratio	2	0	0	

**Question 10: How many people are instructed in using the electronic valves in your household?**

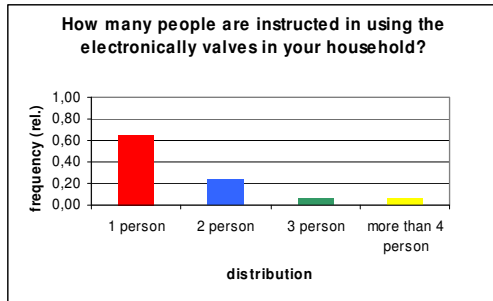


Chart 10: GWV Wittstock

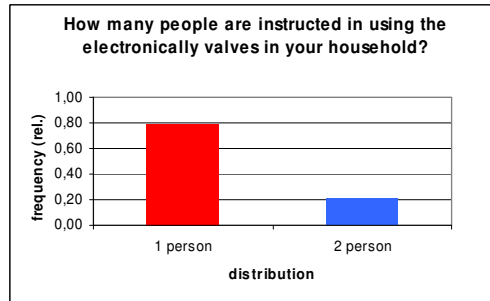


Chart 11: Weissensee eG

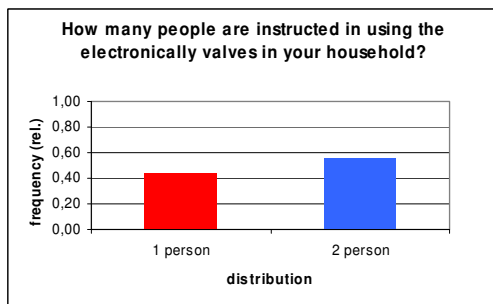


Chart 12: Treptow Nord eG

The questions 9 and 10 show the level of instruction of the tenants to the new valves. According to the answers most of the tenants understood the instruction. The distribution of the number of tenants per household who were instructed differs mainly between one and two persons. The housing associations Weissensee eG and Treptow Nord eG instructed in total not more than two person per household. With about 80 % the housing association Weissensee eG instructed mostly only one person per household.

**Question 11: Are you able to use the electronic valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	82 %	100 %	100 %	
"no"	18 %	0 %	0 %	
Error ratio	1	0	0	

**Question 12: Do you get along with the usage of the central control unit – if installed?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	35 %	0 %	89 %	
"no"	6 %	0 %	11 %	
"not installed"	59 %	100 %	0 %	
Error ratio	1	0	0	

**Question 12.1: Where is the central control unit located in your flat?**

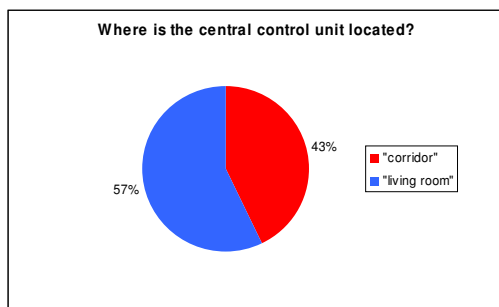


Chart 13: GWV Wittstock

The answers to questions 11 and 12 shall determine the everyday use of the new valves. The answers to the questions reflect that 82-100 % of the instructed tenants are able to handle the valves (see question 11). Additionally, question 12 shall approve if the instructed tenants are able to handle the central control unit – if installed. Only the tenants of the housing associations Treptow Nord eG and GWV Wittstock experienced the usage of the control unit in practice. In general, the tenants who tested the control unit were able to use it without problems (see question 12). The additional question 12.1 shows the location of the central control unit.

**Question 13: Do you agree with the field test or do you feel forced to participate?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	63 %	100 %	100 %	
"no"	31 %	0 %	0 %	
"obliged"	6 %	0 %	0 %	
<b>Error ratio</b>	2	0	0	

The overall acceptance of the field test has been evaluated with 100 % for the housing associations Weissensee eG and Treptow Nord eG very positive. With 63 % positive agreement the acceptance of the tenants for the housing association GWV Wittstock has been considerable lower. 31 % of the tenants did not agree with the field test. 6 % announced that they were "obliged" to participate in the field test.

**8.2.3. Heating and Ventilation Behavior**

**Question 14: Are you satisfied with the heating situation in you flat?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	71 %	84 %	89 %	
"no"	29 %	16 %	11 %	
<b>Error ratio</b>	1	1	0	

**Question 15: Did anyone explain to you the right heating and ventilation behaviour?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	83 %	100 %	100 %	
"no"	17 %	0 %	0 %	
<b>Error ratio</b>	1	1	0	

The questions 14 and 15 involve the assessment of the heating situation in the households. On the whole the tenants are generally satisfied with the heating situation in their flats. According to the answers to question 15, most of the tenants have been instructed on the right heating and ventilation behaviour. The tenants of the housing association GWV Wittstock evaluated on average both questions about 10-20 % below the frequency of the housing associations Weissensee eG and Treptow Nord eG.

**Question 16: Do you have any dark stains or mould in your flat?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	44 %	15 %	-	-
"no"	56 %	85 %	-	-
Error ratio	1	1	-	-

Referring to question 16 the problem of dark stains or mould does exist in some of the participating households. According to the answers this is an existing problem in 44 % and 15 % of the households respectively.

**Question 17a: How warm do you heat your living room?**

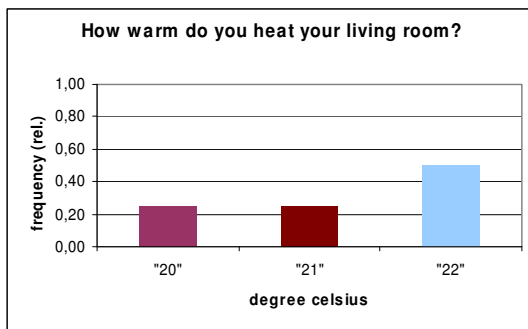


Chart 14: GWV Wittstock

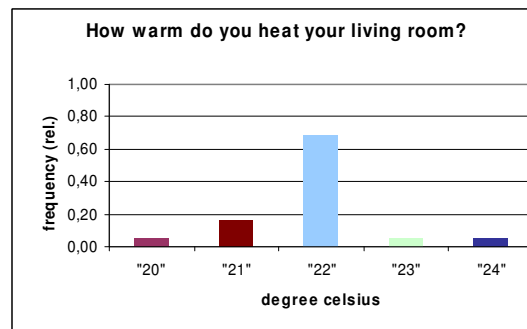


Chart 15: Weissensee eG

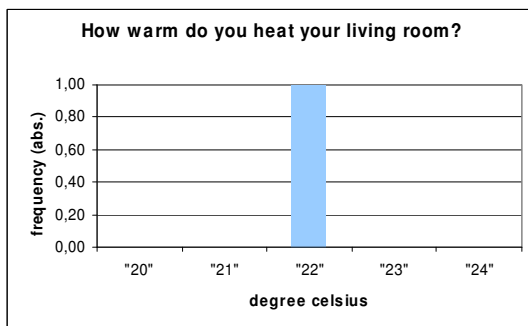


Chart 16: Treptow Nord eG

Concerning the evaluation of the heating behaviour of the participating households the average temperature in the living room is normally set at 22°C in most of the households. The relatively frequency varies between 50 % and 100 % (see chart 13-15).

**Question 17b: How warm do you heat you bed room?**

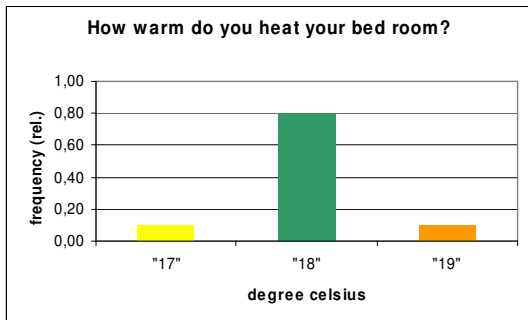


Chart 17: GWV Wittstock

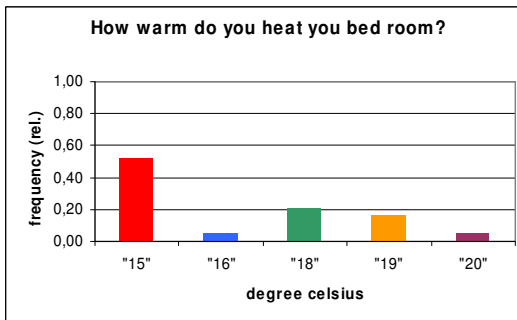


Chart 18: Weissensee eG

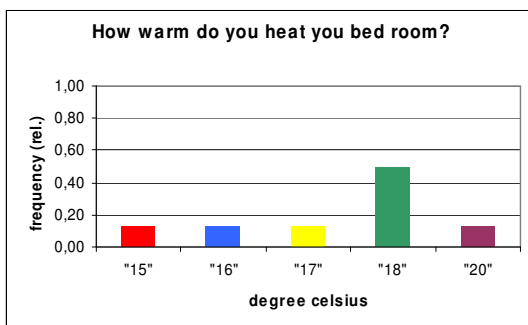


Chart 19: Treptow Nord eG

The evaluation of the average temperature in the bed room of the households illustrates a much more diversified picture. Generally speaking there is a tendency towards a temperature setting of about 18°C. The temperature setting of 18°C varies between 80 % in GWV Wittstock, 21 % in Weissensee eG, and 50 % in Treptow Nord eG. For Weissensee eG the most chosen temperature setting is 15°C in 53 % of the households.

**Question 17c: How warm do you heat your kitchen?**

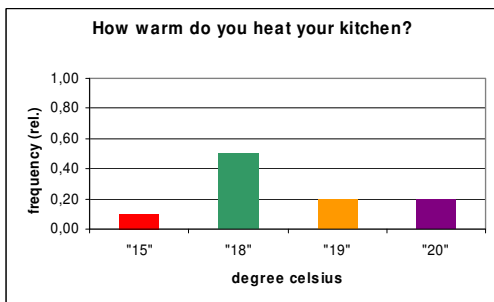


Chart 20: GWV Wittstock

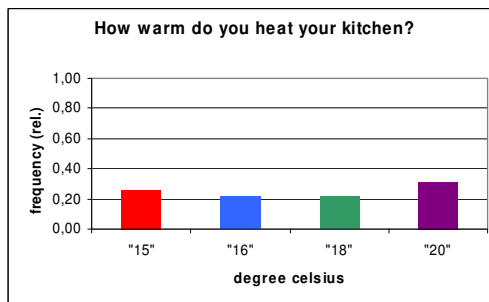


Chart 21: Weissensee eG

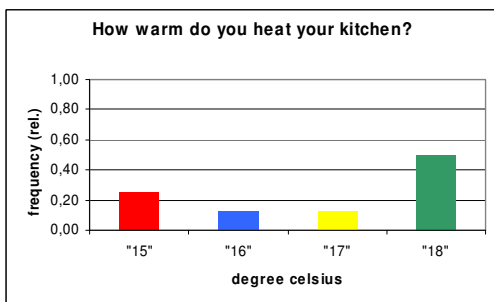


Chart 22: Treptow Nord eG

The temperature settings for the kitchen give a comparable impression to the temperature settings of the bed room. Although the temperature distribution varies between 15 and 20°C it can be noticed that there is the tendency to the temperature setting of 18°C. The household settings of the housing association Weissensee eG is dominated by the temperature setting of 20°C (32 %) before the temperature setting of 15°C (26 %).

**Question 17d: How warm do you heat your bath room?**

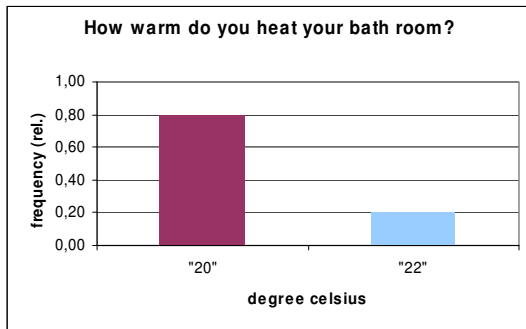


Chart 23: GWV Wittstock

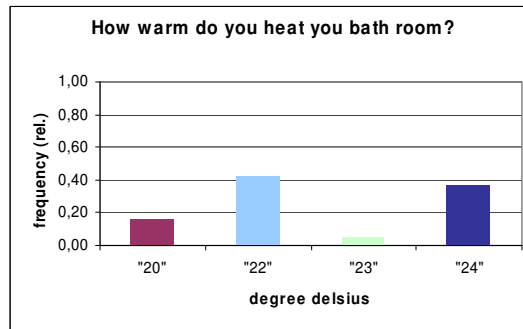


Chart 24: Weissensee eG

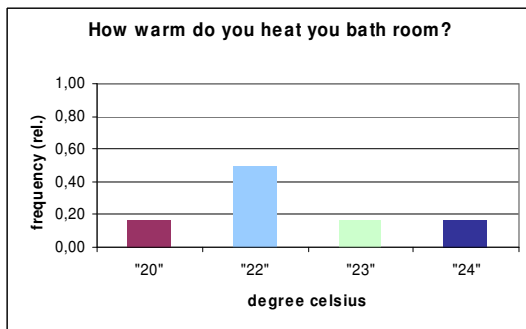


Chart 25: Treptow Nord eG

Similar to the temperature setting of the bed room and the kitchen, the bathroom temperature is dominated with 22°C for Weissensee eG and Treptow Nord eG. The households of GWV Wittstock mainly chose 20°C (80 %). The evaluation of the answers for Treptow Nord eG and GWV Wittstock contained only 6 respectively 5 answers (of a total survey number of 9 and 18 surveys).

**Question 18: Do you turn down the heating while not being in the flat?**

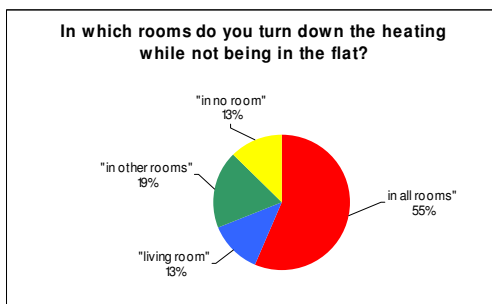


Chart 26: GWV Wittstock

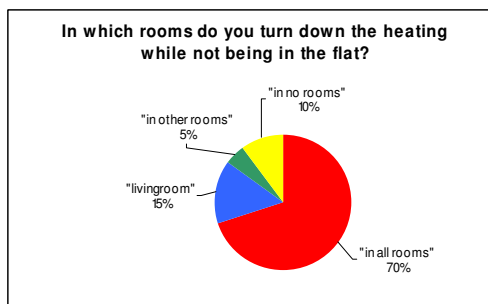


Chart 27: Weissensee eG

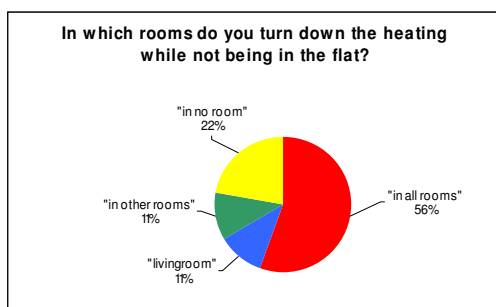


Chart 28: Treptow Nord eG

With a relative frequency minimum of 55 % all households turn down the heating while not being in the flat. The tenants of the housing association Weissensee eG stated that they turn down the heating in all rooms in 70 % of the cases. As a result the tenants do carefully think about existing possibilities of how to reduce the heat energy consumption.

**Question 19: Where do you dry your laundry?**



Chart 29: GWV Wittstock



Chart 30: Weissensee eG



Chart 31: Treptow Nord eG

Depending on the size of the flats and constructional specification the households use different possibilities to dry laundry. For this reason the answers were much diversified. The biggest share for the households of the housing association Weissensee eG consists of the categories "drying room" and "flat" (each 40 %). With a share of 67 % the households of the housing association Treptow-Nord eG dry their laundry at "other places" (balcony etc.). With 56 % of the possible answers the households of the housing association GWV Wittstock dry their laundry in the drying room. For all housing associations it can be said, that the category "laundry dryer" varies between 10 and 11 % of all possible answers.

**Question 20: How you do ventilate your flat?**

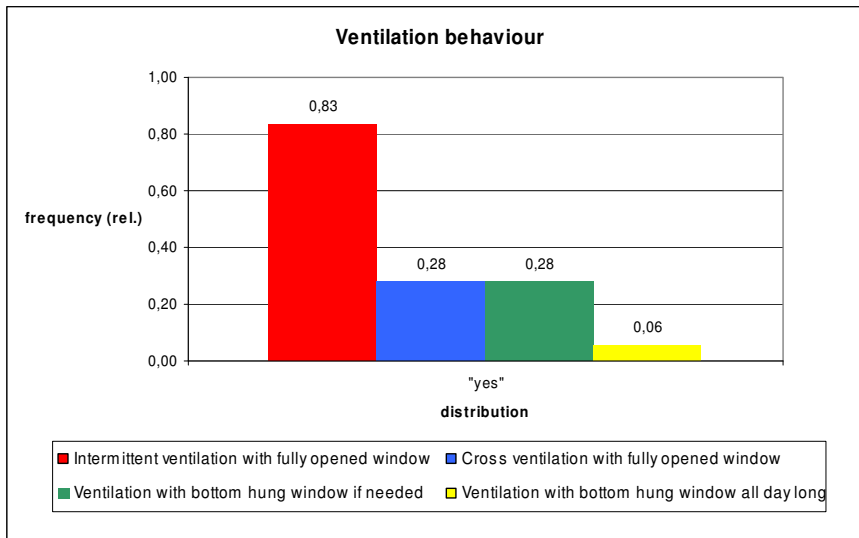


Chart 32: GWV Wittstock

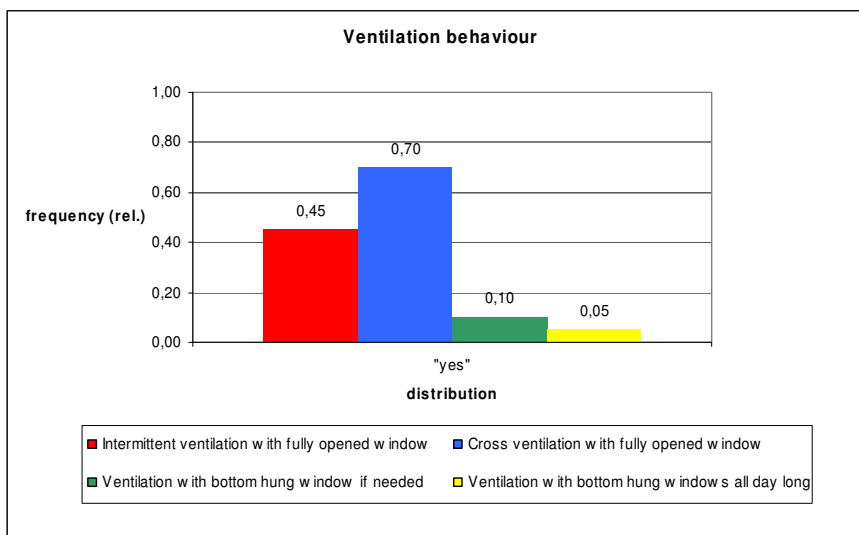


Chart 33: Weissensee eG

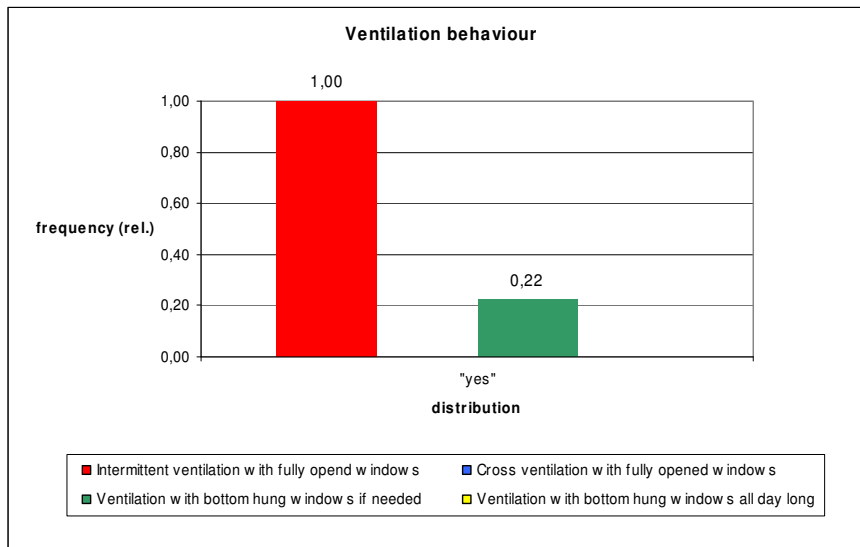


Chart 34: Treptow Nord eG

**Question 21: Do you turn off the heating while ventilating your flat?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	78 %	80 %	78 %	
"no"	22 %	20 %	22 %	
Error ratio	0	0	0	

**Question 22: How many times per day do you ventilate?**

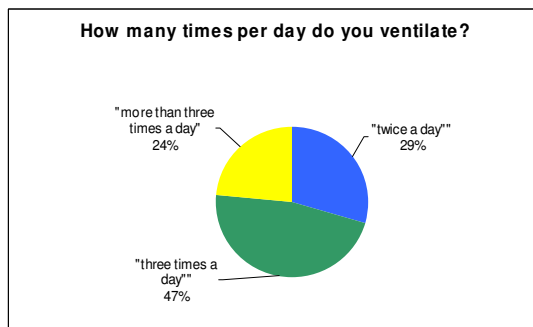


Chart 35: GWV Wittstock

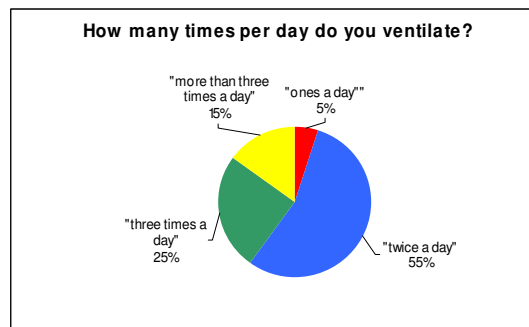


Chart 36: Weissensee eG

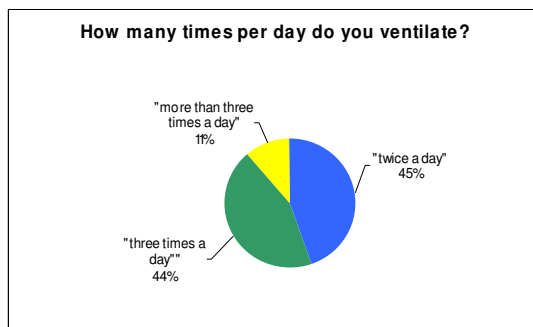


Chart 37: Treptow Nord eG

**Question 23: How long do you ventilate per day?**

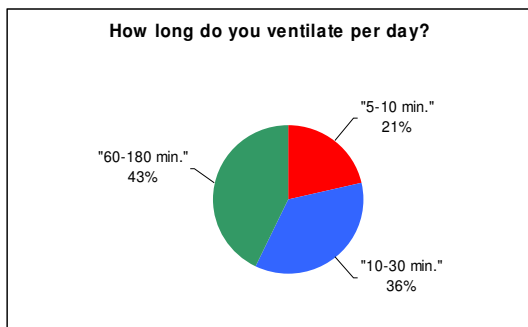


Chart 38: GWV Wittstock

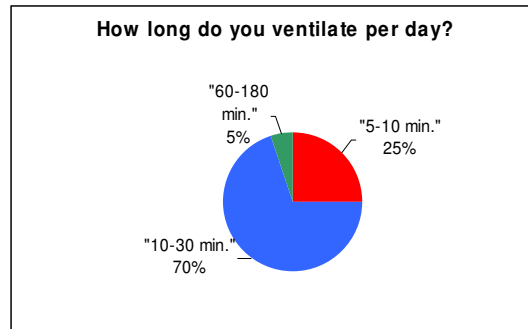


Chart 39: Weissensee eG

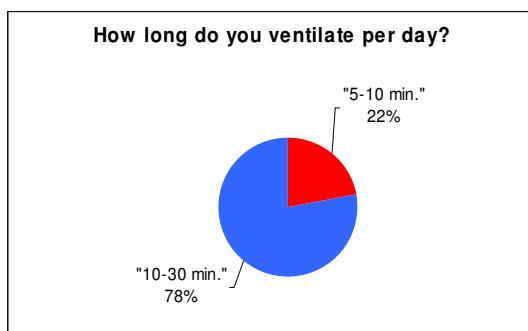


Chart 40: Treptow Nord eG

The type of ventilation behaviour strongly influences the level of heat energy consumption per capita. A dominating ventilation behaviour is not clearly obvious in the households. Nevertheless, it can be said that the biggest share of the evaluated ventilation behaviour is dominated by "Intermittent ventilation with fully opened window" (in order 83 %, 45 %, 100 % of the tenants use this kind of ventilation) and "Cross ventilation with fully opened window". Moreover most of the tenants turn off the heating while ventilating the flat (in order 78 %, 80 %, and 78 %). This answer corresponds with the answers of question 18 (Do you turn down the heating while not being in the flat?). Also the answers to questions 22 and 23 do not give an analogical result. The answers to question 22 do not correspond to question 1 – age distribution of the surveyed tenants – although it could have been expected that tenants who spend more time home also have a higher ventilation frequency. The tenants of the housing association Weissensee eG gave much more diversified answers as in comparison to the tenants of the housing associations Treptow Nord eG and GWV Wittstock. This analysis can be as well transferred to the answers of question 23. Generally speaking the ranges of answers are much alike. Except the answers of the tenants of the housing association GWV Wittstock the dominant duration of the ventilation varies between 10-20 min. daily (in order 70 %, 78 %, 21 %).

**Question 24: Are you interested into further energy saving tips?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	56 %	70 %	22 %	
"no"	44 %	30 %	78 %	
Error ratio	2	0	0	

### 8.3. Second Household Survey

#### Question 1: Did you move into this flat after the installation of the new valves?

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	11 %	11 %	0 %	
"no"	89 %	89 %	100 %	
Error ratio	0	2	0	

This question evaluates if during the field test any of the participated tenants moved in or out. The share of the new tenants is relatively low. But it has to be mentioned as the new tenants did not have the opportunity to experience the installation and the entire field test duration.

#### Question 2: Which thermostatic valves have been installed in your flat?

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"Honeywell HR 40"	63 %	69 %	11 %	
"Honeywell CM Zonen"	38 %	0 %	89 %	
"Heimeier E-PRO"	0 %	31 %	0 %	
Error ratio	2	0	1	

#### Question 3: Do you have an operation manual for the thermostatic valves/central unit?

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	78 %	93 %	90 %	
"no"	22 %	7 %	10 %	
Error ratio	0	1	0	

#### Question 4: Do you find the usage of the new valves suitable for everyday use?

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	75 %	80 %	90 %	
"no"	25 %	20 %	10 %	
Error ratio	2	1	0	

The questions 2-4 of the survey declare what types of devices are installed and the practicability of them in every day use. Next to the information of what kinds of valves have been installed by which housing associations it can be mentioned that 75-90 % of the tenants perceived the utilisation of the new valves suitable for everyday use. Particular the tenants of the housing association Treptow Nord eG – where mainly central units were installed – evaluated the practicability of the valves with 90 % very high.

**Question 5: How often do you change the settings of the control unit?**

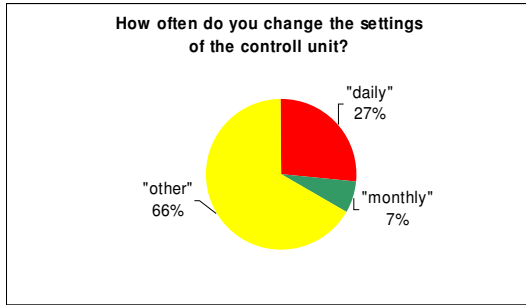


Chart 41: GWV Wittstock

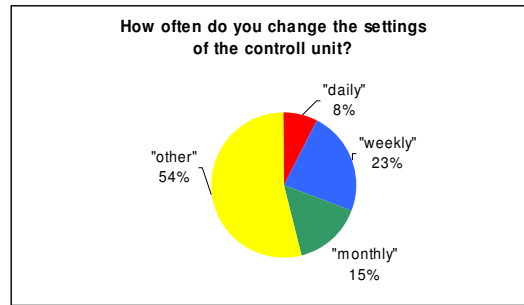


Chart 42: Weissensee eG

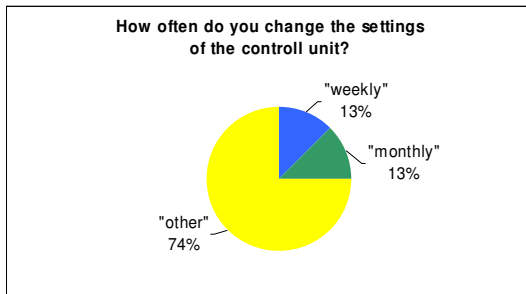


Chart 43: Treptow Nord eG

Once the temperature is set up, most of the tenants do not change the temperature configuration on daily, weekly or monthly base. Based on the answers of the tenants the households overwhelmingly chose an "other" temperature setting which most probably indicates that they never change the setting again.

**Question 6: Did you have any technical problems with the thermostatic valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	41 %	27 %	10 %	
"no"	59 %	67 %	90 %	
Error ratio	1	2	0	

**Question 6.1: If yes, what kind of problems occurred?**

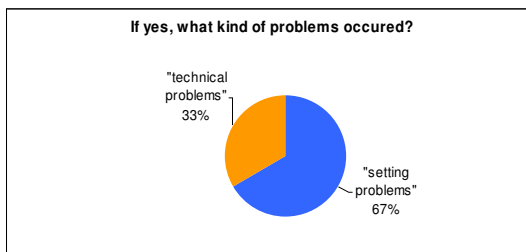


Chart 44: GWV Wittstock

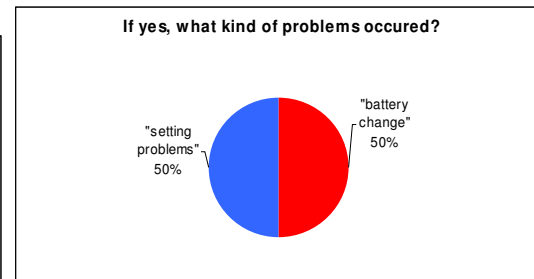


Chart 45: Weissensee eG

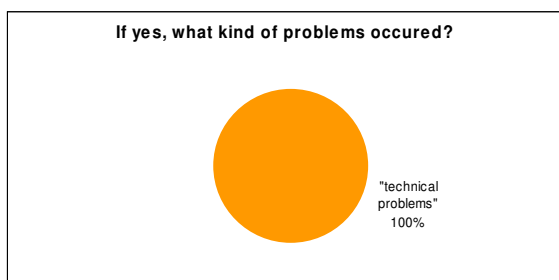


Chart 46: Treptow Nord eG

The occurring problems using the new valves included "battery change", "setting problems" and "technical problems". Due to the fact that "only" 41 % – of absolute 18 responds – of the tenants (GWV Wittstock) reported technical problems it can be concluded that most tenants did not have any problems.

**Question 7: Did you have any problems regarding the handling of the thermostatic valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	25 %	7 %	20 %	
"no"	75 %	93 %	80 %	
Error ratio	2	1	0	

**Question 7.1: If yes, which kind of problems occurred?**

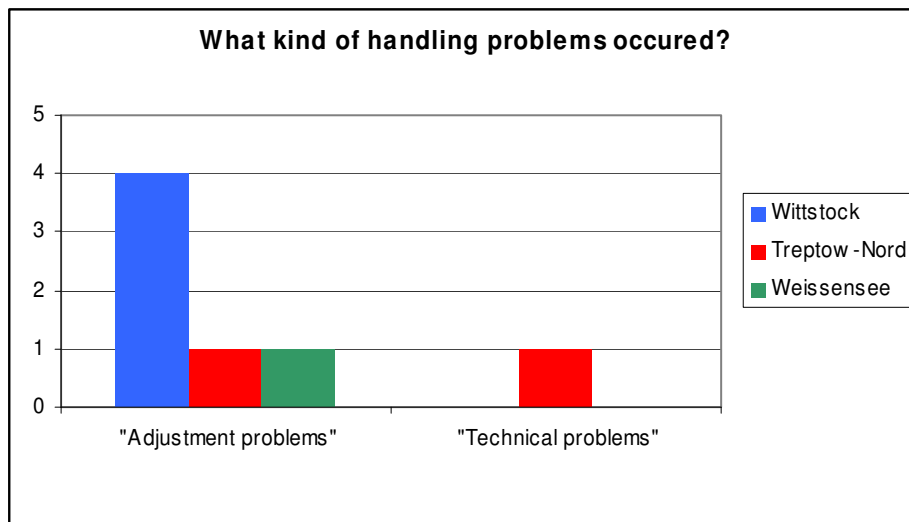


Chart 47: GWV Wittstock, Treptow Nord eG, Weissensee eG

Concerning the handling of the new valves the tenants reported that problems occurred in 7-25 % of the households. Question 7.1 specifies the answers into the categories "Adjustment problems" and "Technical problems". Chart 47 shows that except for one case in Treptow Nord all problems were adjustment problems. Most of the adjustment problems occurred in Wittstock.

**Question 8: Do you perceive the usage of electronic valves as an additional comfort?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	59 %	87 %	90 %	
"no"	41 %	13 %	10 %	
Error ratio	1	1	0	

**Question 9: Do you expect a decrease in your heat energy consumption?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	44 %	60 %	70 %	
"no"	56 %	40 %	30 %	
Error ratio	0	1	0	

According to the answers to questions 8 and 9 the tenants perceived the use of the new valves as an additional comfort and a possibility to decrease heat energy consumption. Particularly the tenants of the housing association Treptow Nord eG evaluated the new valves with 90 % acceptance as an additional comfort. With a share of 70 % the tenants of Treptow Nord eG expect a decrease in their heat energy consumption.

**Question 10: Would you agree once again to the installation of the valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	41 %	79 %	100 %	
"no"	59 %	21 %	0 %	
Error ratio	1	2	0	

**Question 11: Would you recommend the installation of the valves?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	59 %	80 %	100 %	
"no"	41 %	20 %	0 %	
Error ratio	1	1	1	

The positive responses of the tenants to the use of the new valves as shown in questions 8 and 9 are also represented by the answers to the questions 10 and 11 with the highest satisfaction in Treptow (100 %) and the lowest in Wittstock (59 %).

## 8.4. Craftsmen Survey after Implementation of Valves

### Question 1: How large is the quantity of the installed radiators in the flats?

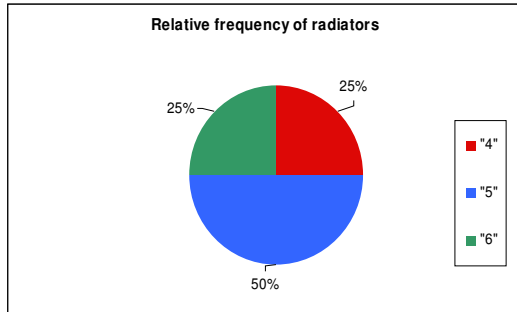


Chart 48: GWV Wittstock

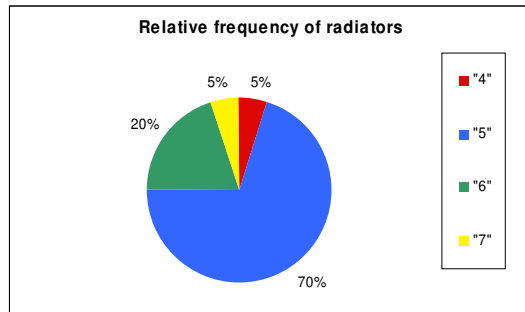


Chart 49: Weissensee eG

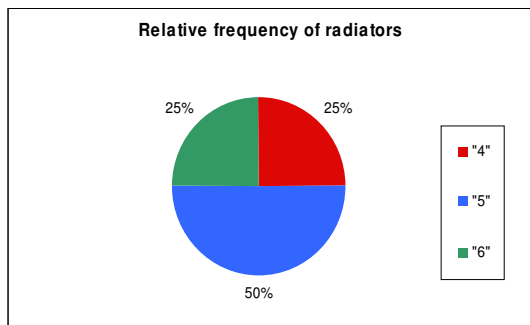


Chart 50: Treptow Nord eG

### Question 2: How long took the installation without instruction?

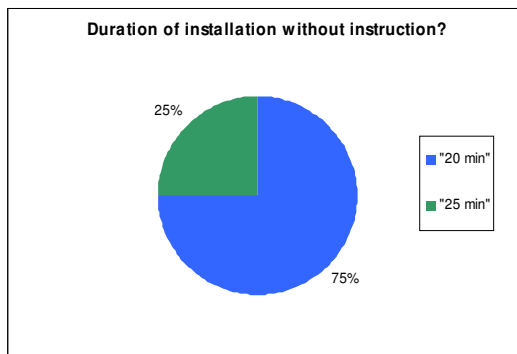


Chart 51: GWV Wittstock

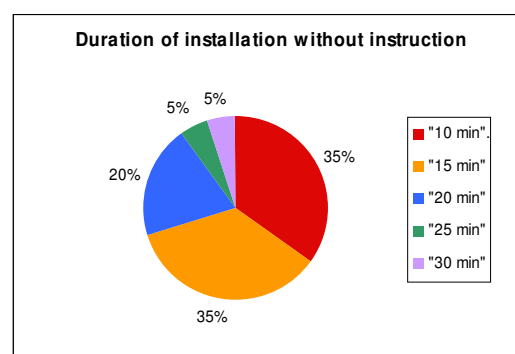


Chart 52: Weissensee eG

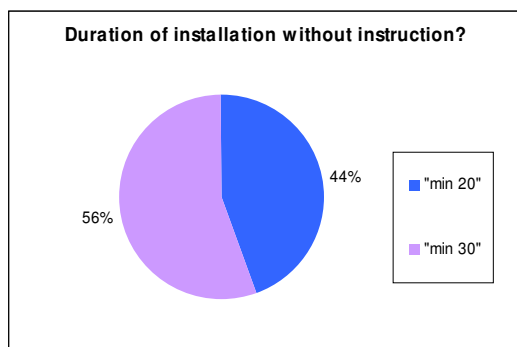


Chart 53: Treptow Nord eG

**Question 3: Which appliances were installed**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"Honeywell"	100 %	55 %	100 %	
"Heimeier"	0 %	45 %	0 %	
Error ratio	0	0	0	

The questions 1-3 refer to the evaluation of the existing infrastructure and the duration of the installation of the valves. As displayed in the charts 48-50, 50 % or more of the flats were equipped with 5 radiators. The remaining share of the housing associations Treptow Nord eG and GWV Wittstock are uniformly distributed (each 25 %) with 4 and 6 radiators in each flat. The distribution of the installation time differed strongly between the housing associations. The installation time in the flats of the housing association Weissensee eG widely varies between 10 and 30 minutes. With a categorial share of each 35 % the instruction was mostly (70 %) carried out between up to fifteen minutes (10 min and 15 min). The installation of the new valves took generally speaking much more time in the flats of the other housing associations (minimum up to 20 min, maximum up to 30 min).

**Question 4: Did the tenant already have experience with the devices?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	0 %	5 %	0 %	
"no"	100 %	95 %	100 %	
Error ratio	0	0	0	

**Question 5: Did the tenant express concerns regarding the handling of the devices?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	42 %	5 %	33 %	
"no"	58 %	95 %	67 %	
Error ratio	0	0	0	

**Question 6: Did the tenant express concerns regarding the living comfort?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	33 %	5 %	0 %	
"no"	67 %	95 %	100 %	
Error ratio	0	0	0	

The answers to question 4 make clear that the tenants (except for one tenant of the housing association Weissensee eG) did not have any experience with electronic controllable valves. On the other hand, most tenants responded positive regarding the handling of the new device (see question 5). Most of the tenants did not express any concerns regarding the living comfort through applying the new device (question 6).

**Question 7: Are the tenants open minded regarding the realisation of the field test?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	83 %	100 %	100 %	
"no"	17 %	0 %	0 %	
<b>Error ratio</b>	0	0	0	

**Question 8: How is the interest of the tenants towards the new valves?**

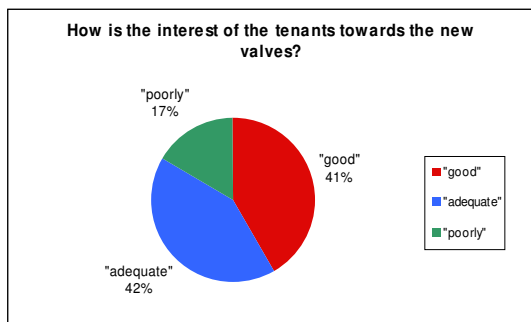


Chart 54: GWV Wittstock

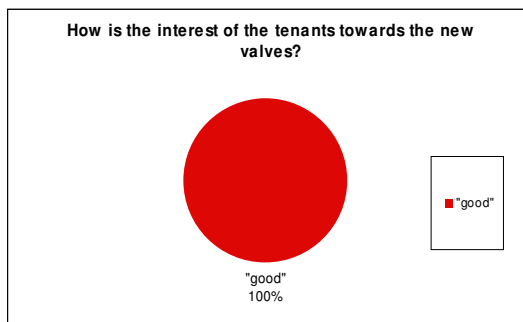


Chart 55: Weissensee eG

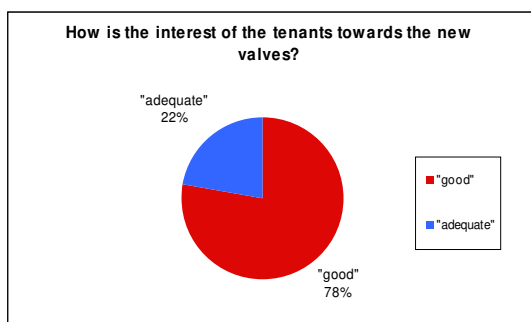


Chart 56: Treptow Nord eG

The agreement towards the realisation and the expected positive effects of the use of electronic controllable valves is supported by the answers to the questions 7 and 8. With 80 - 100% the tenants were very open minded regarding the realisation of the field test (see question 7). The question makes clear that the technicians had the impression that a high percentage of the participating tenants showed "good" (in order 41 %, 100 %, 78 %) or "adequate" (in order 42 %, 0 %, 22 %) interest towards the installation of the new valves. Only 17 % of the tenants of the housing association GWV Wittstock showed a "poorly" interest.

**Question 9: Do you have the impression; the tenants might not be able to handle the devices?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	42 %	5 %	22 %	
"no"	58 %	95 %	78 %	
<b>Error ratio</b>	0	0	0	

According to the estimation of the technicians "most" of the tenants (in order 95 %, 78 %, and 58 %) will be able to handle the devices (see answers to question 9).

**Question 10: Did a technical instruction of tenants take place?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	100 %	100 %	100 %	
"no"	0 %	0 %	0 %	
Error ratio	0	0	0	

**Question 11: How long took the instruction?**

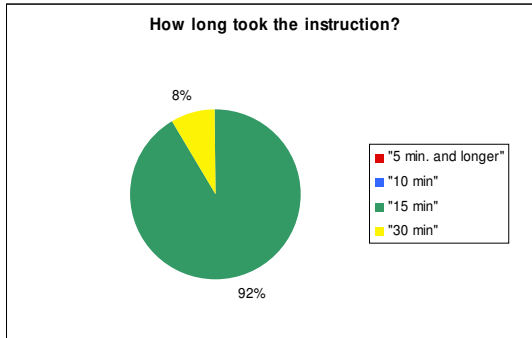


Chart 57: GWV Wittstock

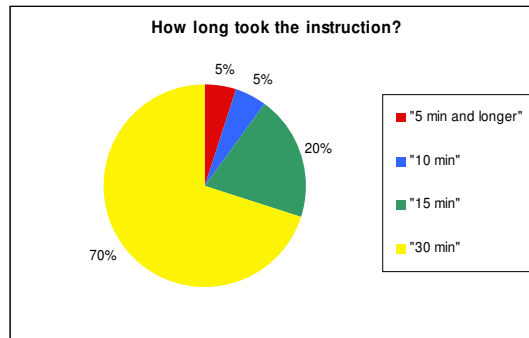


Chart 58: Weissensee eG

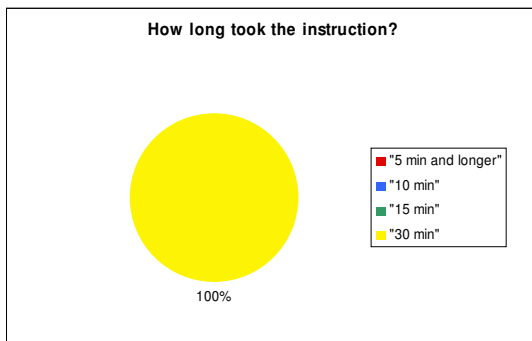


Chart 59: Treptow Nord eG

Apart from the installation of the new valves, the tenants were given a detailed technical instruction. The instruction took place in all of the cases (see question 10). According to the given answers the instruction itself differed between minimum 5 minutes and maximum 30 minutes. Except to the answers of the tenants of the housing association Weissensee eG – the instruction lasted to 70 % about 30 minutes – the tenants of the housing associations Treptow Nord experienced an instruction of 30 minutes (100 %). The instruction of the tenants for the housing association GWV Wittstock lasted to 92 % 15 minutes and to 8 % up to 30 minutes.

**Question 12: How old are approximate the instructed tenants.**

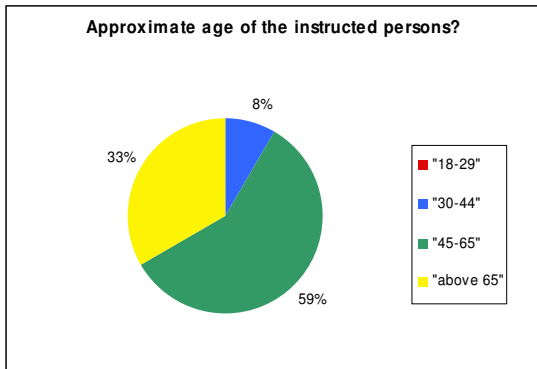


Chart 60: GWV Wittstock

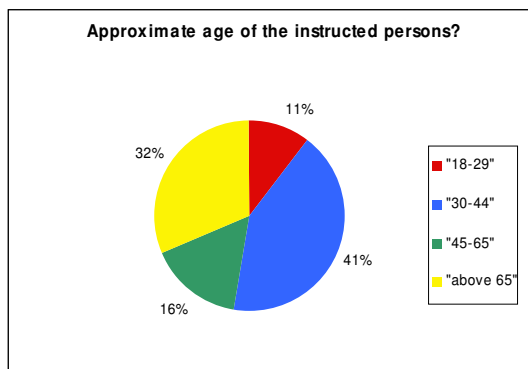


Chart 61: Weissensee eG

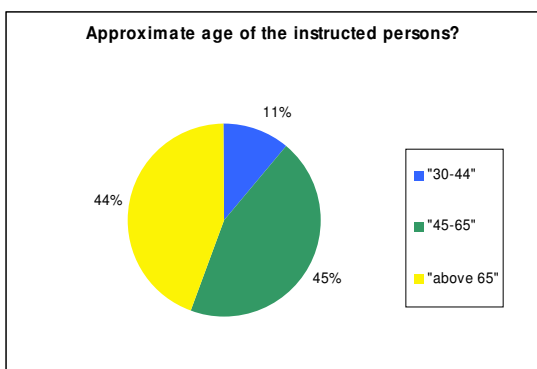


Chart 62: Treptow Nord eG

**Question 13: Was the tenants informed and instructed regarding the battery change?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	100 %	100 %	100 %	
"no"	0 %	0 %	0 %	
<b>Error ratio</b>	0	0	0	

**Question 14: How did the tenants react to their own contribution in form of the battery change?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"not annoying"	58 %	100 %	100 %	
"annoying"	42 %	0 %	0 %	
<b>Error ratio</b>	0	0	0	

According to the answers of the tenants regarding the frequent battery change (once a year), 100 % of the tenants were informed about this matter (see question 13). With a high agreement of 100 %, 100 %, and 58 % the tenants' did not perceive the battery change as an "annoying" task (see answers to the question 14).

**Question 15: How many persons attempted the technical instruction?**

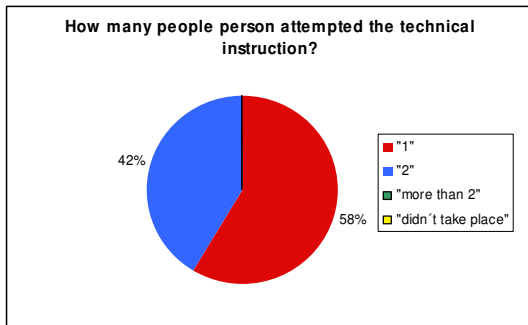


Chart 63: GWV Wittstock

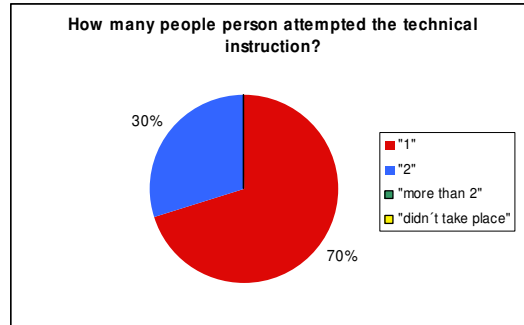


Chart 64: Weissensee eG

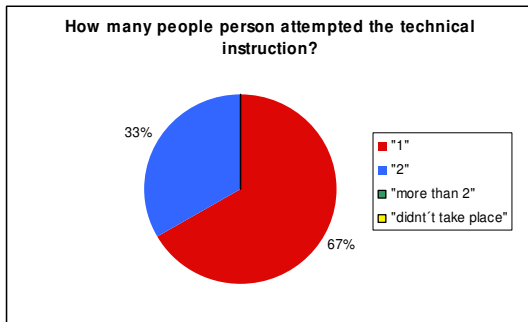


Chart 65: Treptow Nord eG

**Question 16: How great was the interest of the tenants regarding the instruction?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"good"	50 %	100 %	100 %	
"middle"	42 %	0 %	0 %	
"poorly"	8 %	0 %	0 %	
"never mind"	0 %	0 %	0 %	
Error ratio	0	0	0	

**Question 17: Do you believe the tenants will be able to handle the devices on their own?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	42 %	100 %	89 %	
"no"	58 %	0 %	11 %	
Error ratio	0	0	0	

The technician's answers to question 15 make clear that in most cases one person attempted the technical instruction of the new valves. At the very same time the technicians had the impression that most of the tenants will be able to handle the devices on their own (see question 17).

**Question 18: Was it possible to install the valves without problems?**

Company	GWV Wittstock	Weissensee eG	Treptow Nord eG	Charlottenburger eG
"yes"	100 %	90 %	100 %	
"no"	0 %	0 %	0 %	
"mostly"	0 %	10 %	0 %	
"not at all"	0 %	0 %	0 %	
Error ratio	1	0	0	

**8.5. Survey of the Housing Associations**

The survey of the housing associations has been conducted with the responsible person via telephone or the survey has been filled out and sent back to the BEA.

The contact persons of the housing associations are the following:

GWV Wittstock	Mr. Reichelt
Weissensee eG	Mr. Schulz
Treptow Nord eG	Ms. Silbe
Charlottenburger eG	Mr. Scholz

**Question 1: How do you evaluate the organisational work of the field test?**

According to the answers of all interviewees the organisational work of the field test has been evaluated with a moderate (two votes) and with a high organisational work (two votes as well) by the housing associations.

**Question 2: Did the installation of the electronic controllable valves work out properly?**

Generally, yes. The installation of the electronic controllable valves has been carried out properly in all of the evaluated cases.

**Question 3: Did you have any response of your tenants/craftsmen concerning the installation?**

There has been no direct response concerning the installation of the valves neither by the craftsmen nor the tenants.

**Question 4: Did you have any response of your tenants/craftsmen after the installation?**

All of the participated housing associations registered responses of their tenants after the installation (four votes) of the new valves. The responds mostly concerned the use of the electronic controllable valves. It became obvious that in most of the cases the "complaining" tenants belonged to the senior tenants. The GWV Wittstock housing association reported four cases of senior tenants who announced handling problems with the new valves. Altogether two of seven participating households in the field test of the housing association Charlottenburger eG initiated the removal of the new valves the day after the installation.

**Question 5: Did you have any removals or subsequent changes due to the installation of the valves?**

Only in the case of two tenants of the housing association Charlottenburger eG the valves have been removed.

**Question 6: Do you perceive the functioning of the valves as a plus in comfort for the tenants?**

The responds of the housing associations concerning the comfort which can be gained through the use of electronic controllable valves have been quite different. Two of the housing associations announced that they do recommend the valves as a plus in comfort for the tenants. The other two distinguished their answers; particular expressing that the new valves are a useful contribution to the improvement of the living comfort of the tenants if the instruction is easily explained and the tenants are "interested in using the valves" and not perceiving the valves as an extra device which they do not really want to use.

**Question 7: Do you perceive the new valves as extra equipment for you flats?**

The answers to this question varied between the participated housing associations. One housing association explained that electronic controllable valves do not belong to the equipment components; there the valves are extra equipment. Another housing association responded that the new valves do only represent an extra component in case a flat is also equipment with a central control unit. Two denied that the new valves represent an extra equipment component for their flats. One of the housing associations did not comment this statement (written answer) and the other housing association argued that the use of electronic controllable valves does not fit to their tenant clientele (as they mostly belong to the senior tenants). Therefore the tenants in this age are often not willing or able to handle the adjustment of electronic controllable valves.

**Question 8: Do you recommend the installation of the tested valves for other housing associations?**

The participating housing associations would generally recommend the use of electronic controllable valves to other housing associations. One company stated that this decision is dependent on the structure of the tenants. Only one of the four housing associations did not see any potential for the use of electronic controllable valves in multi-family-houses as the valves are more interesting for one-family-houses. This answer has been made regarding the possibility that house owners do have more purchasing power as tenants and therefore are personally more interested in using such types of valves in order to save energy.

**Question 9: Do you consider fitting more flats with electronic valves in the future?**

Based on the field test, the housing associations experienced different results concerning the installation and the use of the valves in practice. Two of the four housing associations are planning to equip further flats with electronic controllable valves. One housing association has not decided yet and would like to get to know the results of this field test. Only one company announced that they would definitely not equip any further flats with the electronic controllable valves.

## 9. ANNEXES



### 9.1. Overview installed valves

The following table represents an overview of the participating households in Wittstock and Berlin.

No.	Housing association	Tenants	Street	Radiators	Manufacturer
1	GWV Wittstock	Lemke	Roebeler Str. 6	5	Honeywell
2	GWV Wittstock	Buchholz	Roebeler Str. 6	6	Honeywell
3	GWV Wittstock	Nitz	Roebeler Str. 6	5	Honeywell
4	GWV Wittstock	Kuhn	Roebeler Str. 6	6	Honeywell
5	GWV Wittstock	Fiedler	Roebeler Str. 6	5	Honeywell
6	GWV Wittstock	Gerbendorf	Roebeler Str. 6	6	Honeywell
7	GWV Wittstock	Zeidler	Roebeler Str. 8	4	Honeywell
8	GWV Wittstock	Müller	Roebeler Str. 8	5	Honeywell
9	GWV Wittstock	Henk	Roebeler Str. 8	4	Honeywell
10	GWV Wittstock	Felgner	Roebeler Str. 8	5	Honeywell
11	GWV Wittstock	Treder	Roebeler Str. 8	4	Honeywell
12	GWV Wittstock	Eggert	Roebeler Str. 8	5	Honeywell
13	GWV Wittstock	Cieslak	Roebeler Str. 8		Honeywell
14	GWV Wittstock	Turau	Roebeler Str. 15		Honeywell
15	GWV Wittstock	Zahn	Roebeler Str. 15		Honeywell
16	GWV Wittstock	Krüger	Roebeler Str. 15		Honeywell
17	GWV Wittstock	Thiede	Roebeler Str. 15		Honeywell
18	GWV Wittstock	Kersten	Roebeler Str. 17		Honeywell
19	GWV Wittstock	Braun	Roebeler Str. 17		Honeywell
20	GWV Wittstock	Schröder	Roebeler Str. 17		Honeywell
21	GWV Wittstock	Franke	Roebeler Str. 17		Honeywell
22	GWV Wittstock	Düsterhöft	Roebeler Str. 17		Honeywell
23	Weissensee eG	Lieber	Hansastraße 150	5	Honeywell
24	Weissensee eG	Päge	Hansastraße 150	5	Heimeier
25	Weissensee eG	Meyer	Hansastraße 152	5	Honeywell
26	Weissensee eG	Goldberg	Hansastraße 152	5	Honeywell
27	Weissensee eG	Klapproth	Hansastraße 154	5	Heimeier
28	Weissensee eG	Rediske	Hansastraße 154	5	Heimeier
29	Weissensee eG	Richter	Hansastraße 156	5	Honeywell
30	Weissensee eG	Bleek	Hansastraße 156	5	Heimeier
31	Weissensee eG	Fichtner	Hansastraße 158	5	Honeywell

32	Weissensee eG	Beka	Hansastraße 160	5	Honeywell
33	Weissensee eG	Riedel	Hansastraße 161	4	Heimeier
34	Weissensee eG	Lange	Hansastraße 162	5	Honeywell
35	Weissensee eG	Moormann	Hansastraße 162	5	Honeywell
36	Weissensee eG	Rückborn	Hansastraße 164	5	Honeywell
37	Weissensee eG	Lange	Hansastraße 164	5	Heimeier
38	Weissensee eG	Rudolph	Hansastraße 165	6	Heimeier
39	Weissensee eG	Böhmer	Hansastraße 167	6	Heimeier
40	Weissensee eG	Thierfelder	Hansastraße 167	6	Heimeier
41	Weissensee eG	Fehl	Hansastraße 168	6	Honeywell
42	Weissensee eG	Holmok	Hansastraße 172	7	Honeywell
43	Treptow-Nord eG	Wünsche	Leiblstr. 17/17a	4	Honeywell
44	Treptow-Nord eG	Bleisch	Leiblstr. 17/17a	5	Honeywell
45	Treptow-Nord eG	Kristokat	Leiblstr. 17/17a	5	Honeywell
46	Treptow-Nord eG	Lange	Leiblstr. 17/17a	5	Honeywell
47	Treptow-Nord eG	Parchatka	Hänselstr. 29	4	Honeywell
48	Treptow-Nord eG	Langer	Hänselstr. 29	4	Honeywell
49	Treptow-Nord eG	Mittenzweig	Hänselstr. 29	4	Honeywell
50	Treptow-Nord eG	Hentke	Hänselstr. 29	4	Honeywell
51	Treptow-Nord eG	Sebastian	Hänselstr. 29	4	Honeywell
52	Treptow-Nord eG	Bohm	Hänselstr. 29	4	Honeywell
53	Treptow-Nord eG	May	Hänselstr. 29	4	Honeywell

## 9.2. Household Survey

Energieeinsparung in Bestandanlagen Fragebogen für Mieter über Heiz- und Lüftungsverhalten	
Name	
Adresse	
Lage/Etage	
Allgemeine Fragen	
supported by:	
	
<p>1. Wie viel Personen leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p> <p>Wie viele Personen zwischen 0-18 Jahren leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p> <p>Wie viele Personen zwischen 18-29 Jahren leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p> <p>Wie viele Personen zwischen 30-44 Jahren leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p> <p>Wie viele Personen zwischen 45-65 Jahren leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p> <p>Wie viele Personen über 65 Jahren leben in Ihrem Haushalt?</p> <p><input type="checkbox"/> 1      <input type="checkbox"/> 2      <input type="checkbox"/> 3      <input type="checkbox"/> 4</p>	
<p>2. Gibt es täglich eine Zeit, in der niemand in der Wohnung ist und die Temperatur</p> <p><input type="checkbox"/> 2-4 Std.      <input type="checkbox"/> 6-8 Std.      <input type="checkbox"/> 10-12 Std.      <input type="checkbox"/> 12-14 Std.</p>	
<p>3. Wissen Sie, wie viel Heizenergie in Ihrem Gebäude durchschnittlich (kWh/m<sup>2</sup> Wohnfläche) verbraucht wird?</p> <p><input type="checkbox"/> Ja      <input type="checkbox"/> Nein</p>	
<p>4. Achten Sie beim Kauf von Elektrogeräten auf den Stromverbrauch?</p> <p><input type="checkbox"/> Ja      <input type="checkbox"/> Nein</p>	
<p>5. Laufen in ihrem Haushalt Geräte über einen längeren Zeitraum im Stand-by Betrieb?</p> <p><input type="checkbox"/> Ja      <input type="checkbox"/> Nein</p>	
<p>6. Benutzen Sie Mehrfachsteckdosen mit Ausschaltern?</p> <p><input type="checkbox"/> Ja      <input type="checkbox"/> Nein</p>	

Feldversuch

---

7. Besitzen Sie einen Videorekorder und beherrschen Sie die Programmierung?

Ja             Nein

8. Haben Sie Steckdosen mit einer Zeitschaltuhr?

Ja             Nein

9. Haben Sie die Einweisung durch den Handwerker, der die Thermostate montiert hat, erstanden?

Ja             Nein

10. Wie viele Personen kennen sich mit der Bedienung der Thermostate aus?

1             2             3             + 4

11. Kommen sie mit der Bedienung der Thermostate zurecht?

Ja             Nein

12. Kommen Sie mit der zentralen Steuereinheit – wenn vorhanden – zurecht?

Ja             Nein             Nicht vorhanden

Wo befindet sich die Steuereinheit?

Flur             Wohnzimmer             Küche             anderer Standort

13. Sind Sie mit dem Testversuch einverstanden oder fühlen Sie sich zur Teilnahme

Ja             Nein             Genötigt

HEIZUNGS- UND LÜFTUNGSVERHALTEN

---

14. Sind Sie zufrieden mit der Wärme in Ihrer Wohnung?

Ja             Nein

15. Wurde Ihnen beim Einzug die Heizung oder das richtige Lüften erklärt?

Ja             Nein

16. Haben Sie dunkle Flecken oder Schimmel in der Wohnung?

Ja             Nein

17. Wie warm heizen Sie folgende Räume (Angabe Temperatur in °C oder Stufe des

- Wohnzimmer:  Schlafzimmer:
- Küche:  Bad:
- Kinderzimmer:

18. Drehen Sie bei Abwesenheit von mehreren Stunden die Heizung herunter?

- in allen Räumen  im Wohnzimmer  in sonstigen Räumen  in keinem Raum

19. Wo trocknen Sie ihre Wäsche

- Wohnung  Trockenraum  Wäschetrockner  anderer Standort

20. Wie lüften Sie?

- Stoßlüftung mit voll geöffnetem Fenster
- Querlüftung mit voll geöffnetem Fenster
- Kippfenster bei Bedarf
- Kippfenster ganztägig

21. Drehen Sie die Heizung beim Lüften aus?

- Ja  Nein

22. Wie oft lüften Sie am Tag?

- 1 Mal pro Tag  2 Mal am Tag  3 Mal am Tag  mehr als 3 Mal

23. Wie lange lüften Sie pro Tag?

- 5-10 min.  10-30 min  1-3 Std.  mehr als ganztägig

24. Haben Sie Interesse an weiteren Tipps zum Einsparen von Strom- und Heizkosten?

- Ja  Nein

## 9.3. 2<sup>nd</sup> Household Survey

### Energieeinsparung in Bestandanlagen: Nachbefragung Für Mieter über Erfahrungen mit elekt. Thermostatventilen

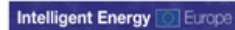
Name: \_\_\_\_\_

Adresse \_\_\_\_\_

Lage/Etage: \_\_\_\_\_





supported by:



#### NACHBEFRAGUNG ZUM FELDVERSUCH

1. Sind Sie nach dem Einbau der elektronischen Thermostatventile in diese Wohnung eingezogen?  
 Ja             Nein
2. Welche Thermostate wurden in Ihrer Wohnung eingebaut?  
 Honeywell HR 40             Honeywell CM Zonen (ZE)             Heimeier E-PRO
3. Verfügen Sie über eine Bedienungsanleitung für die Thermostatventile/Zentraleinheit?  
 Ja             Nein
4. Finden Sie die Anwendung der Thermostatventile alltagstauglich?  
 Ja             Nein
5. Wie oft ändern Sie die Einstellung der Regeleinheit?  
 täglich             wöchentlich             monatlich             sonst.
6. Gibt es technische Probleme bei den Thermostatventilen?  
 Ja             Nein  
Wenn ja welche Probleme treten auf?
7. Gibt es Probleme bei der Anwendung oder Bedienung der Thermostatventile?  
 Ja             Nein  
Wenn ja welche Probleme treten auf?
8. Empfinden Sie die Nutzung von elektronischen Thermostatventile als Komfortgewinn?  
 Ja             Nein
9. Erwarten Sie nach ihrer Einschätzung eine Heizenergieeinsparung?  
 Ja             Nein
10. Würden Sie dem Einbau der Thermostatventile nochmals zustimmen?  
 Ja             Nein
11. Würden Sie den Einbau der Thermostatventile weiterempfehlen?  
 Ja             Nein

## 9.4. Survey Technicians

<b>Energieeinsparung in Bestandanlagen</b> <b>Fragebogen für Handwerke zum Feldversuch</b>		 BERLINER <i>energie</i> AGENTUR
Adresse		
Mietername		
Lage/Etage		supported by:
Allgemeine Fragen		 Intelligent Energy Europe
1. Wie groß ist die Anzahl der Heizkörper im Haushalt? <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7		
2. Wie lange dauerte die Montage ohne Einweisung? <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7		
3. Welche Gräte kommen beim Mieter zum Einsatz? <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4		
4. Hat der Mieter bereits Erfahrung mit solchen Geräten? <input type="checkbox"/> Ja <input type="checkbox"/> Nein		
5. Gab es Sorgen des Mieters bezüglich der Bedienung? <input type="checkbox"/> Ja <input type="checkbox"/> Nein		
6. Gab es Sorgen des Mieters bezüglich des Komforts? <input type="checkbox"/> Ja <input type="checkbox"/> Nein		
7. Ist der Mieter der Studie gegenüber aufgeschlossen? <input type="checkbox"/> Ja <input type="checkbox"/> Nein		
8. Wie ist das Interesse der Mieter gegenüber den neuen Thermostaten? <input type="checkbox"/> Gut <input type="checkbox"/> Mittel <input type="checkbox"/> Schlecht <input type="checkbox"/> Gleichgültig		
9. Glauben Sie, dass der Mieter mit der Einstellung der Geräte überfordert ist? <input type="checkbox"/> Ja <input type="checkbox"/> Nein		

10. Wurde eine Mietereinweisung für die Geräte vorgenommen?

Ja  Nein

11. Wie lang dauerte die Einweisung in diesem Fall?

5 min.  10 min.  15 min.  sonst.

12. Ungefähres Alter der eingewiesenen Person?

18-29  30-44  45-65  über 65

13. Wurde der Mieter über den Batteriewechsel informiert und eingewiesen?

Ja  Nein

14. Wie wurde die Eigenleistung des Mieters zum Batteriewechsel empfunden?

nicht störend  störend

15. Wie viele Personen waren bei der Einweisung der Geräte dabei?

1  2  mehr als 2  nicht erfolgt

16. Wie groß war das Interesse der Mieter bei der Einweisung?

gut  mittel  schlecht  gleichgültig

17. Glauben Sie, dass der Mieter langfristig die Geräte allein einstellen kann?

Ja  Nein

18. Konnten die Thermostate ohne Probleme (Möbel, enge Nischen) eingebaut werden?

ja  Nein  Meistens  gar nicht

## 9.5. Survey Building Companies

### Energieeinsparung in Bestandanlagen: Nachbefragung Für Wohnungsbaugesellschaften über Erfahrungen mit elektronischen Thermostatventilen

Name: \_\_\_\_\_

Wohnungsbaugesellschaft: \_\_\_\_\_

Adresse: \_\_\_\_\_

Datum: \_\_\_\_\_



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#### FRAGELISTE ZUM FELDVERSUCH

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1. Wie beurteilen Sie den organisatorischen Aufwand Ihres WU hinsichtlich des Feldversuchs?
2. Hat der Einbau der elekt. Thermostatventile problemlos funktioniert?
3. Gab es Rückmeldungen der Handwerker/Mieter zum Einbau der Ventile?
4. Gab es Rückmeldungen von Handwerkern/Mietern nach Einbau der Ventile?
5. Gab es Rückbauten bzw. nachträgliche Veränderungen aufgrund der Thermostatventile?
6. Empfinden Sie den Einsatz von elekt. Thermostatventilen als Komfortgewinn für die Mieter?
7. Stellen elekt. Thermostatventile ein besonderes Ausstattungsmerkmal für die Wohnungen dar?
8. Würden Sie anderen WU den Einbau von elekt. Thermostatventilen weiterempfehlen?
9. Werden Sie zukünftig weitere Wohnungen mit elekt. Thermostatventilen ausstatten?