Project no. TREN/05/FP6EN/S07.51327/006255

act2

Action to mainstream energy efficient building and renewable energy systems at a city level across Europe

Integrated Project

D 2.4 Documentation of monitoring program (including equipment etc.)

Due date of deliverable: m18
Actual submission date: m24

Start date of project: jan 2006   Duration: dec 2010

Organisation name of lead contractor for this deliverable: proKlima
Revision [1]

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Monitoring program

D 2.4 Documentation of monitoring program including equipment etc.

December 2007

Table of Contents

1. Purpose of this document

This paper gives an overview of the monitoring program of act2 in the cities of Hannover and Nantes as at the end of 2007. It summarises the main definitions and methods to be used and describes the monitoring equipment of the demonstration objects, realised so far. Further details can be found in the additional documents, added in the annex or referenced to (see chapter 5).

The first part (chapter 2), dealing with the basic principles of monitoring, will mainly refer to the guidelines for monitoring and evaluation (D 2.2) [1]. Chapter 2 describes, how these principles have been developed further and how they will be used in concrete in the act2 demonstration objects.

The second part (chapter 3) is mainly based on the collection scheme (D 2.1) [2] and gives a comprehensive overview of the demonstration objects planned in Hannover and Nantes with the standards referred to, the parameters to be monitored and the measuring equipment to be used.

In the third part (chapter 4) selected objects, which have been realised already or which are in an advanced planning stadium, are presented in a more detailed manner with a documentation of the measures and the metering equipment, the performance data, the predicted energy saving and an overview of all metering points with a schematic representation, if applicable.

2. The basic principles of monitoring in the act2 project

The general rules for monitoring have been defined by Concerto-Plus in a "monitoring impact assessment agreement" [3], widened and adapted to the special conditions in Hannover and Nantes in the guidelines for monitoring and evaluation (D 2.2) [1], which are regularly updated. The actual version (as at December 2007) is added in annex 7.1. The most important aspects with the concretions developed so far are described in the following paragraphs.

2.1. Concerto area

All expected results of the Concerto activities in Hannover and Nantes are related to the Concerto area. According to [3] there are three different possible definitions:

- community level: area of the whole municipality or region respectively. This definition will only be used for the evaluation of the effect of political strategies etc. but not for the evaluation and the monitoring of the Concerto-projects.

- district level: it refers to those parts of the city or region, in which the Concerto projects take place and is used for evaluating the changes of total energy consumption in those areas. These changes can only be estimated because of the great number of buildings in the district level (with unknown energy consumption) compared to the relative small number of Concerto-projects. Because this development can only be estimated, but not be measured without extravagant expenses, the district level will only be used for qualitative extrapolations of the success realised in the demonstration objects.

- **object level**: summary of all Concerto demonstration projects. This definition will be used for act2 in Hannover and Nantes: all indicators used to evaluate the success of the activities describe the effects produced solely by the single demonstration objects.

2.2. Methods of monitoring and system boundaries

The accuracy of the monitoring results as well as the necessary effort to obtain them depends on the monitoring method. The following four different methods will be used for monitoring according to data availability, necessity of exactness and level of Concerto area:

- **Metering** (measurement of physical data during a defined time period at a defined time step) will get the most exact results and therefor be used whenever it is possible with acceptable costs, i.e. mainly if meters can be used, which are installed anyway[1].

- **Collection** (enquiry of data at energy consumers or providers) is not as reliable as an explicit metering, because the circumstances of getting the original data are not always known in detail.

- **Calculation** (calculation of data following a defined methodology) will for instance be applied to divide metered gas consumption into proportions for heating (referring to average weather conditions) and DHW preparation (see chapter 2.4) or to calculate the space heating energy demand under standard conditions according to the national regulations (EnEV in Hannover or RT2005 in Nantes).

- **Estimation** (assessment on basis of statistical analysis) will have to be used, if there is no other way to obtain the data with an acceptable effort, e.g. by using average values for DHW consumption per person or for auxiliary electricity demand for pumps, as to be found in literature or national regulations.

The excel files (e.g. object-matrix.xls), developed for the collection scheme (see chapter 3) will give an overview for all objects about the monitoring methods used to get the different data and indicators. They additionally give information about the time steps (yearly or monthly) and the spatial resolution (per building or flat).

In addition to those quantitative methods the Concerto-monitoring also includes qualitative descriptions of buildings, energy supplying systems and realised measures for the purpose of **documentation**. Therefor excel files (e.g. documentation-ee.xls) have been developed in the collection scheme (see chapter 3) as a sample to be used in Hannover and Nantes with only small variations in detail according to the different conditions in the two cities or regions respectively and the different building and object types. For some objects the documentation files with first monitoring results are already presented in chapter 4.

One of the main targets of monitoring in act2 is to evaluate the realised energy savings due to Concerto measures. This is a not trivial task insofar as it often requires to compare two different

---

[1] In the act2 project there will only be some non-residential demonstration objects, which will be fitted with metering equipment especially used for Concerto. In most cases the regular meters of the energy providers will be used as data sources. Thus physical measurement will always be understood as metering, no matter if the meters will be read off and delivered by the energy provider or directly within the Concerto project. In contrast, collection will be understood as procuring anonymous data for non-Concerto objects or as getting data from "unofficial" sources.

energy levels: the energy demand (or energy needs) and the energy consumption (delivered energy): energy demand is the (calculated) amount of energy needed to compensate the energy losses due to heat transmission and ventilation, whereas energy consumption means the (metered) energy input, delivered to the building. As described in [4], independently from the monitoring type it is therefore necessary to define system boundaries and the different levels of energy flows (see fig 2 in [1]) with the data points of measurement in order to get precise definitions for the indicators required by DG-TREN (see chapter 2.5).

In order not to compare apples and oranges, clear rules have to be observed concerning the monitoring method to be applied dependent on the energy level and the data availability:

- **Metering** of the input of delivered energy consumption will result in the real consumption of the respective time period. It depends not only on the energy standard of the building, but also on the weather conditions (which can be corrected by calculation, see chapter 2.4) and the (unknown) user behaviour and other coincidences. An analysis of the reason for possible deviations of the saving targets (construction mistakes, different usage) is not possible. Metering affords a technical equipment.

- By means of **calculation** methods it becomes possible to compare the status before and after the Concerto measures under defined conditions on a theoretical level (energy demand). The contribution of the different factors (insulation, system efficiency, user behaviour…) can be analysed, but without a comparison with the metering data a validation of the real success of the project is not possible. In the case of a difference between metered and calculated values the reason is not clear. Nevertheless Concerto-Plus recommends the calculation approach as basis for the indicators because of the rather low effort to be taken (see below).

- For the act2 project it was decided[2] to use a **combination of metering and calculation**. This makes a rather high effort in terms of a calibration procedure necessary (see below), but it allows a meaningful analysis of project success: by means of variation of the different calculation parameters it is possible to interpret possible differences between metered and calculated data and thus getting hints on the reasons. So the monitoring results can be part of a quality check of the measures.

As shown in figure 1 Concerto-Plus defines different data levels: the data point DP2 for energy use (input of delivered energy) is the point, where energy **consumption** is usually metered (gas flow meter or heat flux meter in the case of district heating). Data for DP2 will therefore be available for the time after construction (in the case of new buildings) or refurbishment (in the case of retrofitted buildings) of the demonstration object.

---

[2] at least for Hannover, the exact procedure for Nantes still has to be cleared
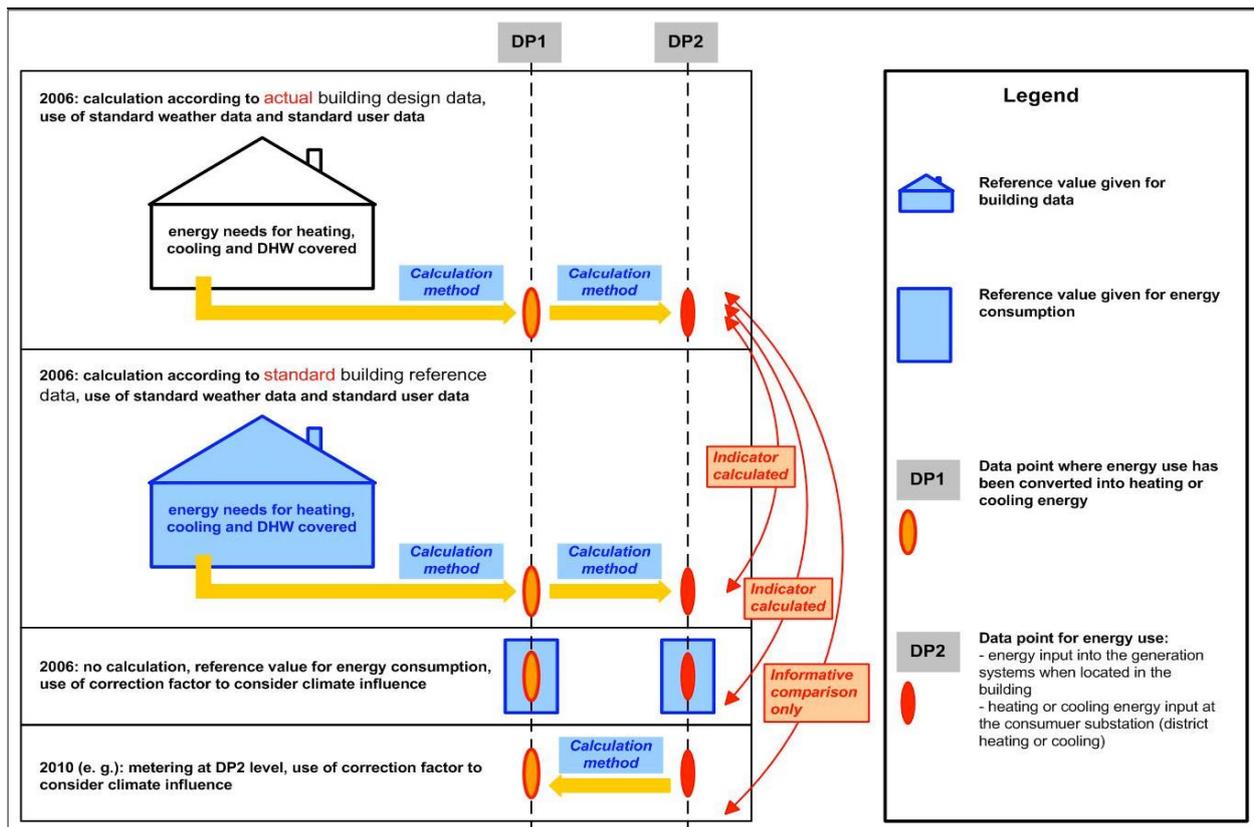
figure 1: definition of reference values and calculation methods [4]

In contrast, the data point DP1 describes the heating **demand**, i.e. the energy needs after conversion to heating (or cooling) energy to compensate losses by transmission and ventilation and keep the designated room temperature. The heating demand usually can't be measured with reasonable effort, but can be calculated by means of calculation, e.g. the German national regulations (EnEV)[3]. To compare it with monitoring data of energy consumption the metered data have to be transformed by a "backward" calculation step (e.g. multiplication with the efficiency factor and - if so - addition of energy generated inside the building, e.g. from a solar collector) and corrected to standard conditions (climate and user behaviour, see chapter 2.4).

In addition especially for new buildings reference values (e.g. from a national database[4] for different building types) can be used to describe the energy use either on the level of DP1 (demand) or DP2 (consumption), if the effort for the above described calculation is too high.

---

[3] The French regulation RT2005 doesn't calculate the energy demand, but a primary energy consumption ('Cep') based on a standard occupancy scheme and standard climate. It integrates, in addition to the transmission and ventilation heat losses, the losses due to the generation, distribution, regulation, stocking of hot water and heat emission and the consumption from ventilators, pumps and lighting. In Nantes, this calculation will be used to estimate the energy consumption DP2, with adaptation (more accurate climate and occupancy scheme entries).

[4] The German rules for EnEV ("Regeln für Energieverbrauchskennwerte im Nichtwohngebäudebestand sowie Vergleichswerte für Nichtwohngebäude") give reference values in kWh/m²a for different types of non-residential buildings for standard climate conditions. The norm VDI 3807 ("Energieverbrauchskennwerte für Gebäude") also presents data for residential buildings.

One of the main targets of Concerto monitoring is to calculate a set of indicators required by DG-TREN describing the energy savings achieved by Concerto measures in comparison with the baseline or national standards (see chapter 2.3 and 2.5) . According to [4] it is not useful to compare a baseline or reference values (based on defined standard conditions and mainly referring to DP1) directly with metered data from the monitoring period (also influenced by weather conditions, user behaviour etc. and metered at DP2). It is therefore proposed in [4] to perform two different approaches for evaluation:

- The **ex-ante evaluation** is based on calculated values for the energy demand only, performed at the beginning of the measures (2006 in figure 1) and should be basis for calculation the indicators.

- The **ex-post evaluation** may compare the metered energy consumption after the Concerto measures with the status before the Concerto measures and so comparing the energy savings realised in practice with the prognosis based on the ex-ante evaluation. A direct comparison of the metered consumption of the Concerto monitoring period with a baseline or the planned standards is not recommended, mainly because of the different energy level and the unknown influence of the user behaviour. The ex-post evaluation should therefore only be used at an informative level and not to calculate the indicators.

As mentioned above, it was decided for act2 to perform several calculations for the metered energy consumption of the monitoring period (correction according to chapter 2.4) as well as for the predicted energy use according to the calculation program PHPP (in order to make it comparable with the metered values of the monitoring period). For that purpose a rather sophisticated procedure was developed (see chapter 2.4 and annex 7.2) for calibrating the (ex-ante) calculation results with the metered consumption of the historical status by varying the input parameters depending on user behaviour. In this manner the problems described in [4] shall be avoided and a meaningful comparison of the metered data with the ex-ante prognosis be made possible.

The Excel software PHPP (Passive House Projection Package) is a tool for the integral planning of passive houses and an effective instrument to calculate the heating energy demand of all low energy buildings and was chosen because of its proven realistic results. The disadvantage is that it is so far not designed for retrofitting of buildings to a non-passive-house standard. The main problem of PHPP is that so far only heating and ventilation systems suitable for passive houses are integrated. For an easy application of PHPP for Concerto planners, a special Concerto version was prepared, based on the actual program version (PHPP 2007). This was possible, because the whole tool has been programmed as an excel sheet with all formulas visible. The main changes were:

- Adding a non-mechanical ventilation (open the windows by hand)

- Adding an auxiliary table with efficiency factors of old heating systems

- Adding Hannover climate

- Hiding not needed registers for a better overview

- Adding a table with all relevant results

This special PHPP version will be used for calculating the heating energy consumption of all EE-demonstration objects (on three different levels see chapter 2.3) in Hannover. For the ob-

jects in Nantes the calculation procedure of the French energy saving regulation RT2005 will be used (see footnote 3 on page 7). Furthermore the RT2005 and the EnEV procedure – associated with PHPP if possible - will be compared for two objects in Nantes.

2.3. Definition of baselines and standards

According to the regulations of the act2-contract and the BEST-tables in its annex, different baselines have to be defined, depending on the building category and the taken measures. In any case the metered data of energy *consumption* will be taken as baseline. Only if there are no metered data available (as for new buildings), a simulation with a software tool basing on the theoretical energy *demand* will be performed, as described below.

- **Baseline** = status before Concerto measures: for new buildings this status will be defined by the national regulations (i.e. EnEV for Hannover and RT2005[5] for Nantes), for RES objects it will be a comparable average object without RES

This baseline will be compared with one or more of the following **standards** according to the BEST-tables of the act2 contract:

- Minimal-Standard of Legal requirements (i.e. EnEV for Hannover and RT2005[5] for Nantes)

- Concerto-standards, defined on three different levels for Hannover and four in Nantes[6]:

  - For Hannover : EnEV-new, Kronsberg and 50% saving

  - For Nantes: Housing, Office, EcoTech and Existing standard

- Best practice technology (BPT)

- Best available technology (BAT)

The standards relevant for the different demonstration objects are presented in the documentation files given for each object (see sample documentation_ee.xls in the collection scheme, chapter 3 and [2]). The examples for the first objects in Hannover are presented in chapter 4.

For the demonstration objects in Hannover all standards refer to the EnEV calculation method. Nevertheless these objects will be calculated additionally with the Excel software tool PHPP[7] (see chapter 2.2), which has been chosen because of its proven realistic results.

A detailed instruction (see annex 7.2) has been developed to calibrate the PHPP-program referring to the historic status by varying the most relevant user-dependant input parameters (as room temperature, ventilation rate or internal energy gains) in order to fit the calculations to the

---

[5] At the time of the Concerto contract in France lower standards were valid (RT2000), which have been tightened in 2005 (RT2005). Thus all projects with a building application before 2005 refer to RT2000 as a baseline, the later ones to RT2005. The regulation only refers to new buildings, since November 2007 additional requirements for re-construction measures (maximum u-values) are valid too.

[6] For detailed definitions compare [1] and the excel file standards.xls in the collection schema (see chapter 3 and [2])

[7] The EnEV calculation method is designed as a proof of the legal requirements under defined (and partly unrealistic) general conditions and explicitly not appropriate for the prediction of the energy consumption. Evaluations showed that the calculated value is often significant lower than the real value, especially for low energy buildings.

climate-corrected average of the past three years. By adapting the so found realistic conditions concerning user behaviour to the other standards a "transformation" of a standard building to the actual building according to figure 1 is made. So a meaningful comparison of the different levels (energy needs or demand under standard conditions vs. energy input or consumption respectively under actual conditions) becomes possible and provides for a realistic evaluation of the heating energy savings. These evaluation compares the actual status after Concerto measures with the calculated prognosis and with the status, which would have been achieved according to the EnEV requirements for retrofitting.

2.4. Data acquisition and correction

If possible all relevant energy data will provided by the local energy provider or the housebuilding company used for billing. These companies meter the energy consumption of the objects in regular metering points (gas or heat flux meters, in some cases heat cost allocators). Only in some objects (mostly larger demonstration objects and RES systems) special meters have to be installed additionally.

For the Hannover objects the energy data of the last years (2005-2006, status before Concerto) have already been collected from Stadtwerke Hannover for all residential objects known so far (see file objects.xls in [2]). Usually the data will be delivered once a year from now on.

In the case of the Lister Bad an input-output controller has been installed to pick out all relevant data of the solar system. For the 2007 season the solar-data has been picked out by BfWT (the manner of reading off has to be cleared for the future), the gas and electricity consumption of the total object will be got from the energy management department of the city of Hannover.

A more detailed description of the data quality (monthly or yearly, per building or flat), the method of monitoring, the measuring equipment, the different metering points and a graphical system schema is presented in the collection scheme (see chapter 4 and especially the excel files documentation_xyz.xls/metering in annex 7.6).

As described in [1] all original data have to be corrected to standard conditions by eliminating the influence of different time steps, the accidental weather conditions, etc. For this purpose the following guidelines and tools have been developed:

- A procedure to calculate the heating energy consumption (annex 7.2). It describes how to calculate the average heating energy consumption by eliminating the influence of climate, domestic hot water preparation (DHW) and (if so) cooking. In a second step it deals with the "calibrating" of the PHPP calculation by varying the parameters of user behaviour like ventilation rate and room temperature. Accordingly the procedure uses diagrams with standard values depending on the energy standard and the wind exposition.

- A guideline for the acquisition of climate and weather data (see annex 7.3) and an excel tool which contains the day degree data (so far only for Hannover) and which performs an automatic correction to a standard period of 365 days for any given start and final datum during the Concerto period.

2.5. Measurement of thermal comfort

In 14 flats of 10 buildings in Hannover comfort measurements have been carried out by the Passive House Institute in January and February 2007. By sensors and other instrumentation (data logger, thermo camera) different parameters (air- and surface-temperature, humidity, air-turbulence, radiation temperature asymmetry, CO_2-emissions) have been measured over a short period (0,5 hour) respectively a long period (1 week). The definitions of comfort as well as the methods for measuring the relevant parameters and the metering equipment used are described by the Passive House Institute in the "Guidelines for Measurements", added as annex 7.5. A first evaluation of the results was presented in a temporary report in German language.

From these measurements thermal comfort indicators like "Predicted Mean Vote" (PMV) and "Predicted Percentage of Dissatisfied" (PPD) can be derived.

2.6. Indicators for impact assessment

As described in [4] the ex-ante evaluation of the Concerto outcome is mainly performed on the basis of a set of indicators, which may be divided in two main groups:

- **Obligatory indicators** are defined in Annex of act2 contract and the Concerto-Plus agreement on monitoring and impact assessment [3].

  - A set of four technical indicators will be used for a basic technical impact assessment, two indicators each for objects with renewable energy supply and with energy efficiency measures (eco buildings). Among these, the indicator 4 ("**Overall reduction in conventional energy consumption**") is the one of most interest, because it summarises the effects of all efficiency gains and the renewable energy supply.
  According to [4] the technical indicators shall be used mainly for an ex-ante-evaluation based on calculations under standard conditions; an ex-post evaluation should be performed at an informative level only (see chapter 2.2)

  - Another six non-technical indicators describe the area of new/refurbished eco-buildings, the power (MW) of new renewable energy systems, the costs per m² and the costs per kWh produced in RES.

  - According to the act2-contract (WP 2: Monitoring and evaluation) some more object related data and benchmarks have to be metered or calculated for each demonstration object with a higher time- or space-based resolution, i.e. on a monthly basis or per flat respectively.

- **Additional indicators**, which are voluntary and shall be used for a deeper analysis, are

  - Technical indicators as the **environmental benefits** of the measures and

  - Non-technical indicators as "Predicted Mean Vote" (PMV) and "Predicted Percentage of Dissatisfied" (PPD) describing the **comfort-level** (see chapter 2.5)

All indicators may be evaluated for the different **object categories**

- RES: renewable energies

- RES + EE: renewable energies and energy efficiency measures

- EE: energy efficiency measures

and further sub-categories, describing the age (old –new), the utilisation (semi-/detached/multi-occupancy-houses, non-residential buildings) and the energy system (biomass, solar, ...).

For further information compare the files "indicators.xls" and for the object related aspects the files "object matrix.xls" and "documentation_ee.xls" in the collection scheme (see chapter 3 and annex 7.4) and the examples for the first objects in Hannover and Nantes, presented in chapter 4.

3. General collection schema for monitoring and evaluation

Whereas the Guidelines for Measurement describe the methodology and the more general aspects of monitoring, an information system with an overall collection schema for all Concerto objects had to be produced in order to collect all relevant information transparently according to a unique master. This "Collection schema for buildings and construction details" [2] gives an overview of all important definitions, standards and categories related to the concrete objects in Nantes and Hannover as well as a sample for documentation. It was developed 2006 as deliverable D 2.1 and has to be updated continuously.

The actual version from December 2007 is added as annex 7.4 and 7.5 (thermal comfort). For some objects the collection scheme has already been filled (partly) with concrete figures according to the actual status of performance (see chapter 4). All relevant input parameters of technical monitoring, which have to be fixed for the technical database (developed by Concerto-Plus), are integrated in this collection schema. This scheme consists of a set of excel files which are described in the following chapter.

3.1. Energy, cost and environmental parameters

The first files have been designed for a quick overview of the Concerto project and a reference of all relevant definitions. They are valid for all objects in the same manner or present a matrix with the relations between the general aspects and definitions and the single buildings and plants respectively:

- **Definition of standards** (standard.xls):
  This file defines the standards for all demonstration objects in Hannover and Nantes. The file contains an overview over the general conditions and a definition for each standard, required for Concerto funding. Additionally the legal requirements and reference values for best practice (BPT) and best available technology (BAT) are listed. For each standard the total space heating demand of an average building is presented as an example.
  The file consists of 4 sheets, one each for the residential and the non residential buildings in Hannover and Nantes.

- **Definition of indicators** (indicators.xls):
  This file gives the definition of all indicators according to the act2 contract (see chapter 2.5). They are valid in principal for all demonstration objects, but not each indicator can be calculated for each object. The object related information will be given in the files object matrix.xls and documentation_ee.xls.

- **Overview of all objects and allocation to the workpackage numbers according to the EU-contract** (workpackage.xls):
  This file gives an overview over all workpackages (WP) in Hannover and Nantes. There is a description of each group of local actors with the addresses and main data of all objects planned with the short characteristics of the measures planned, the standard to be fulfilled and the allocation to the WP numbers.
  The file contains a sheet for Hannover, an analogue sheet for the demonstration objects in Nantes will be added.

- **List of demonstration objects** (objects.xls):
  This file gives a rather detailed overview over all demonstration objects in Hannover and Nantes with a description of the main characteristic values, the measures, the standard to be fulfilled and the metering equipment.
  The file consist of 4 sheets, describing the residential and non residential buildings in Hannover and Nantes.

The following file has several sheets with the same structure, each with the information of one demonstration object:

- **Overview of how to get the indicators in the demonstration objects** (object matrix.xls):
  This file describes for each object, how to determine the different indicators. For each indicator a short abbreviation indicates the way of gathering the data (metering, calculation, collection or estimation), the area concerned (object, flat or Concerto area) and the time intervals (monthly, yearly or once in the Concerto period). Each object in Hannover and Nantes is presented in an own sheet.

The last set of files are designed as samples to illustrate the form of the documentation as planned so far. There will be one file for each demonstration object (for examples of objects realised so far, see chapter 4):

- **Sample for documentation of a demonstration object with energy efficiency measures** (documentation_ee.xls):
  This file gives a short documentation of a demonstration object with EE measures (energy efficiency). The file contains the following sheets:

  - Overview: a short description of the main characteristics, the standard realised by the object in comparison with legal requirements and with Concerto-standards and a summary of the most important results (energy consumption and costs)

  - Measures: a short description of the main parts of the building and the heating system with a description of the status before reconstruction and of the main measures

  - Costs: a short description of the main parts of the building and the heating system with the costs of each measure, if possible with differentiation according to different cost categories (the costs due to refurbishment, to energetic improvement and to Concerto additional requirements).

  - Standards_indicators: overview over all indicators with relevance for this object with numerical values (if calculation already has been performed)

- Metering: description of the metering equipment of the object and the time interval for the readout (monthly or yearly). For all relevant energy values, which cannot be measured the method of monitoring (way of calculation) is given.

- Monitoring: list of all collected energy data

- **Example of documentation of a demonstration object with renewable energy measures** (documentation_res.xls):
  This file gives a short documentation of the demonstration objects with RES measures (renewable energy sources). Because of the different conditions and applied technologies for each object, this file is only an example to show the principles. The documentation files of the demonstration objects may differ according to the requirements of the individual object. The file of this example contains the following sheets:

  - Overview: short description of the main characteristics, summary of the most important results (energy consumption and indicators)

  - RES system: short description of the main parts of the object and the heating system

  - Costs: overview over the investment and energy costs

  - Indicators: overview over all indicators with numerical values for all indicators with relevance for this object

  - Metering: description of the metering equipment of the object

  - Monitoring: list of all collected energy data

4. Documentation of collection schema for selected demonstration objects

In **Hannover** as far as the end of 2007, 24 eco-buildings with 9989 m² in 206 flats have been refurbished according to Concerto standard "EnEV-Neubau". This are three multi-occupancy blocks of the building company Gundlach (Ernst-Eiselenstr. 1, 3, 5 and Ernst-Eiselenstr. 2, 4, 6, 8 and Auf dem Hollen 15,17,19) and four multi-occupancy blocks of the building company Spar- und Bauverein (Linsingenstr. 33, 35, 37, Linsingenstr. 46, 46 a-c, Linsingenstr. 31, 31 a, 31 b and Hirtenweg 18, 20, 22, 24).

The first non-residential RES-object, the solar absorber for the swimming pool in the Lister Bad has been finished too.

In **Nantes** one demonstration object has been realised so far, it is the 'Résidence des Forges', which is part of the renovation and extension of the 'Port-Beaulieu' Hostel for Young Workers led by Atlantique Habitations. The building is made of 45 one- and two-room apartments and some collective rooms dedicated to common services.

To give an impression of the collection schemes a selection of already realised objects is documented in annex 7.6 with the object related files of the collection schema (documentation_xyz.xls) and the data available so far:

- Hannover: Ernst-Eiselenstr. 1, 3, 5, Linsingenstr. 33-37 and Lister Bad

- Nantes: Résidence des Forges and Immeuble Fonderies

5. References

[1] D 2.2 Guidelines for measurement input and consumption of energy flows, economical, environmental and comfort levels (ISO 7730)

[2] D 2.1 Collection schema for buildings and construction details

[3] Arsenal (Susanne Geissler, Doris Österreicher, Olivier Pol), 4.12.2006: monitoring impact assessment_agreement_061204_v3.pdf

[4] Arsenal (Olivier Pol, Doris Österreicher), ECEEE 2007 SUMMER STUDY • SAVING ENERGY – JUST DO IT!: Evaluation methodology to assess the theoretical energy impact and the actual energy performance for the 27 communities of the European CONCERTO initiative

6. Glossar

act2	Action to mainstream energy efficient building and renewable energy systems at a city level across Europe
BAT	Best available technology
BEST	Building Energy Specification Table
BPT	Best practice technology
DG-TREN	Directorate-General for Transport and Energy
DHW	domestic hot water
EE	Energy efficiency
EnEV	Energie-Einspar Verordnung (German energy saving order)
PHPP	Passivhaus-Projektierungs-Paket (Passive House Planning Package)
RES	Renewable energy system
RT2000/RT2005	Réglementation thermique (french order for reglementation of building energy performance)

7. Annex

7.1. Guidelines for monitoring and evaluation, update as at December 2007

7.2. Procedure for calculation of the heating energy consumption for different energy standards (Vorgehensweise zur Berechnung des Heizenergieverbrauchs für unterschiedliche energetische Standards)

7.3. Acquisition of Climate and Weather Data as part of the Concerto monitoring guidelines for the cities Nantes and Hannover

7.4. Collection schema for buildings and construction details, update as at December 2007

7.5. Tanja Schulz, Passivhaus Institut: Guidelines for Measurements of Thermal Comfort

7.6. Collection schemes for selected objects

7.6.1. Ernst-Eiselenstr. 1, 3, 5

7.6.2. Linsingenstr. 33-37

7.6.3. Lister Bad

7.6.4. Immeuble Fonderies

7.6.5. Résidence des Forges