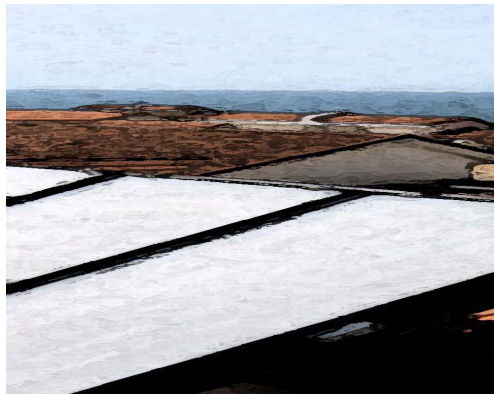


MONITORING GUIDELINES

for the Pilot Projects



**IN THE FRAMEWORK OF THE
MED-ENEC PROJECT**

**– ENERGY EFFICIENCY IN THE CONSTRUCTION SECTOR
IN THE MEDITERRANEAN –**

Date: 27.08.2008



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1 BACKGROUND

In the framework of the MED-ENEC project, ten pilot projects shall demonstrate best practices and new technologies as well as integrative approaches for the efficient use of energy and the use of renewable energies in the building sector in the MEDA countries.

Up to now, 10 pilot projects were selected in a public competition. Contracts between all pilot projects initiatives and MED-ENEC were concluded to support the implementation and monitoring of the pilot projects as well as the documentation and publication / dissemination of the achieved results.

In the contracts the pilot project initiatives and MED-ENEC agreed to develop together a concept for monitoring the pilot projects in order to assure sustainability, e.g. the replication of the project after the end of the MED-ENEC Project.

These monitoring guidelines shall ensure that in all pilot project initiatives similar approaches are followed. Therefore minimum standards are set for

- the monitoring of energy performance of the pilot projects
- the monitoring of economic performance of the pilot projects
- adequate procedures for future monitoring and learning processes

Within the timeframe of the contract a detailed monitoring concept will be developed and the monitoring equipment will be installed. The monitoring procedures shall be continued after the ending of the contract by the pilot project initiative.

The final monitoring concept shall be approved by MED-ENEC.

2 MONITORING PROCEDURE

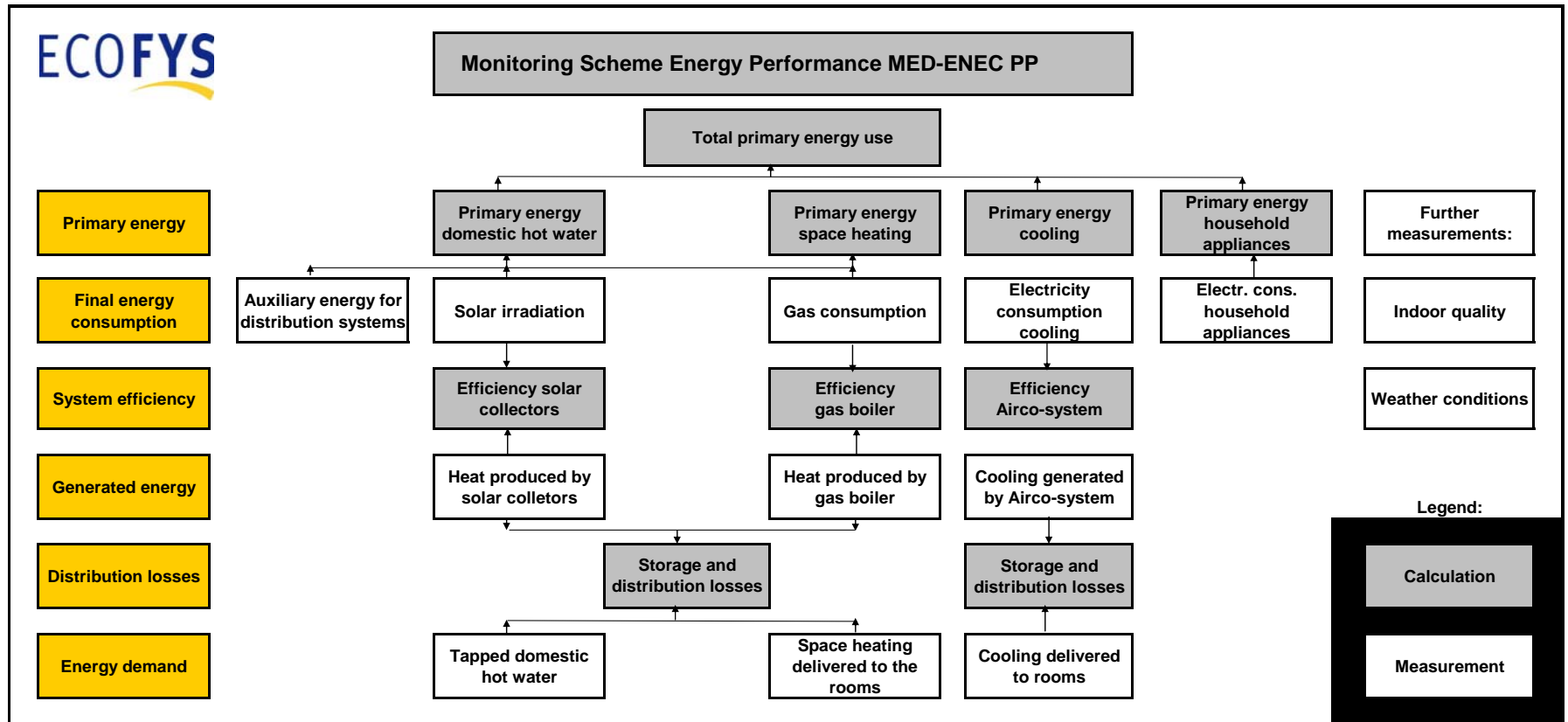
The development and execution of the monitoring concept can be divided into the following steps:

- Development of monitoring concept
 - o Development of performance indicators in order to judge the success of the pilot project. Both, energy/environmental and economic aspects will be documented and assessed.
 - o Definition of reference (conventional solution) and planning as baseline values for indicators
 - o Determination which parameters can be measured
 - o Determination which parameters will be calculated from the measured values
 - o Flow diagram of monitoring of energy performance (see below)
- Selection of measurement equipment (electricity meter, heat meter, meter for irradiation, etc.)
- Installation of measurement equipment
 - o The equipment will be financed by the Pilot Project, therefore parts of the financial contribution of MED-ENEC in the framework of this contract can be used for these incremental costs
- Testing of measurement equipment
- Establishment of monitoring procedures
 - o Who will be responsible for the measurement and documentation?
 - o Who will be responsible for the data analysis?
 - o Time planning of measurements
- Execution of monitoring

The following chapters focus on the development of a monitoring concept and the establishment of the monitoring procedures.

3 MONITORING OF ENERGY PERFORMANCE

- Development of energy related performance indicators, minimum indicators are:
 - o Total energy consumption of pilot project per time unit (at least month and year)
 - o Energy consumption for certain applications (e.g. cooling, heating)
 - o Energy generated by renewable energy systems
 - o Saved energy compared to building in conventional construction (baseline, standard solution) in % and in absolute terms. Estimation of comfort level increase (as part of theoretically saved energy).
 - o Efficiency of the energy systems in comparison to conventional and best available technologies
- Definition of reference and planning as baseline values for indicators
 - o Total energy consumption of standard solution and planned total energy consumption of pilot project (PP)
 - o Energy consumption for certain application of standard solution and planning PP
 - o Standard weather data for location/ area
- Determination of parameters to be measured, e.g.
 - o End energy consumption (gas, electricity, oil, heat, etc.)
 - o Energy consumption for cooling, space heating, domestic hot water, etc
 - o Energy generation by renewable energy systems or energy efficient systems (e.g. solar thermal, photovoltaic, heat pumps)
 - o Weather conditions (either at location or from existing weather station nearby (e.g. airport, if nearby) to compare with average weather
- Determination which parameters will be calculated
 - o Efficiency of systems (e.g. heat pump, solar collectors, boilers) in comparison to conventional and best available technologies
 - o Specific energy consumption related to conditioned floor space (cooled or heated floor space excluding not conditioned areas like cellar or outdoor areas).
 - o Energy savings plus comfort increase in relation to standard solution per year
 - o Specification and documentation of used conversion factors (e.g. from m³ gas to kWh gas or primary energy factor for electricity)
- Monitoring scheme to visualise monitoring concept for energy performance



All parameters should be calculated and documented for the total pilot project in MWh/a and as specific values related to floor space in kWh/m²a. Savings shall be given in MWh/a and kWh/m²a as well as in %.

4 MONITORING OF ECONOMIC PERFORMANCE

All costs to be calculated in Euros (total and per m²), pls. indicate exchange rate.

- Development of indicators for economic performance, minimum indicators are:
 - o Total and additional (compared to standard solution) investment costs of PP
 - o Annual energy costs of PP in total and per energy carrier
 - o Other annual operational and maintenance costs of energy-related equipment of PP such as maintenance of air conditioner
 - o pay back period with sensitivity analysis of strongly increasing energy prices.

- Definition of reference and planning
 - o Total investment costs of standard solution and PP (planning)
 - o Annual energy costs of standard solution and PP (planning)
 - o Other operational and maintenance costs of standard solution and PP
 - o planned additional investment costs for PP compared to standard solution
 - o planned energy cost savings for PP compared to standard solution
 - o planned additional annual operational and maintenance costs of PP
 - o

- Determination of parameters to be acquired/monitored
 - o Realised total investment of PP
 - o Realised annual energy costs for PP (in comparison of planned costs for standard solution)
 - o Realised other annual operational and maintenance costs of standard solution and PP
 - o Table of paid energy prices per energy carrier over time

- Determination which parameters will be calculated/monitored
 - o Realised additional investment costs
 - o Realised annual cost savings (in Euros and in %)
 - o Realised difference in other annual operational and maintenance costs
 - o pay back period for additional investment costs

Many PP are focusing on proven and cost effective technologies to demonstrate energy efficiency measures and renewable energies. In some projects additional measures will be implemented which have a certain research and development character.

To show future perspectives of energy efficiency and renewable energies in the building sector, it is important to demonstrate also technologies which are under development. However, MED-ENEC is focussing on replicable technologies, for which cost-effectiveness is the main decisive parameter.

If technologies with high demonstration character and less focus on cost-effectiveness are implemented in a pilot project, it is important to analyse the cost effectiveness on two levels:

- total cost effectiveness with all measures (full project)
- cost effectiveness for only those measures which are replicable in other projects excluding high-cost measures with research & development character (cost-effective “basic” version of the project)



5 ESTABLISHMENT OF MONITORING PROCEDURES

The monitoring concept shall include monitoring procedures. This means that the following responsibilities shall be fixed. Thereby companies, persons or institutes have to be identified, who will be responsible for the

- Overall monitoring
- Measurement of the necessary energy data
- Data acquisition of the necessary economic values
- Analysis of energy performance of PP and comparison to standard solution
- Analysis of economic performance of PP and comparison to standard solution
- Conclusion of lessons learned
- Publication of lessons learned

In an annexed monitoring time-plan, it should be clearly defined, who monitors what indicator when (how often) with what equipment. This check-list may be used even after the end of the MED-ENEC project.