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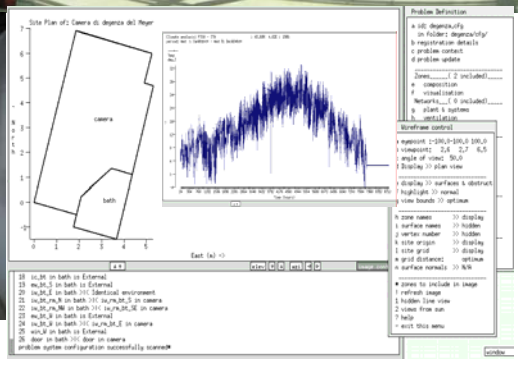
Project Number: **NNE5-2001-00295**

Title of Project: **HOSPITALS - Exemplar Energy Conscious European Hospitals and Health Care Buildings**

Monitoring Plan

H O S P I T A L S



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1. Introduction

Monitoring activities are necessary in order to evaluate in practice the specific and the global energy and environmental quality of the hospital and to evaluate energy saving due to innovative elements used.

The monitoring phase has been postponed and planned to start in July 2005 (instead of January 2005) for 6 months after the construction of Meyer Hospital.
The delay of the monitoring phase is due to the delay of the renovation of Villa Ognissanti: the administration of Meyer Hospital after several meetings has decided that it is not possible use part of the hospital without the possibility to use Villa Ognissanti in which all offices and administration of the Hospital will be located.
This is the reason why the monitoring has been postponed.

It will be done with continuous measurements of outdoor environment, indoor environment, systems operation and energy use e.g. space heating & cooling, electricity for ventilation & lighting, thermal comfort.

2. Objectives

- To investigate and assess real performance of implemented strategies and features
- To assess the global environmental and energy performance including energy conservation, thermal and visual comfort and indoor air quality.

3. Description of work

Monitoring may comprise of a long monitoring for a period of six months and a short monitoring for a period of four months with spot measurements (Winter & Summer), in order to measure the main thermal, energy characteristics.
This will include the distribution of the air temperature in the main zones, the specific energy consumption, the distribution of the wall and roof surface temperatures indoor and outdoor, solar radiation and all relevant meteorological parameters, etc.
Finally, in order to characterize the thermal performance of the buildings after the application of the retrofit measures all the necessary inputs will be available. All data will be submitted to a quality control and data sets will be prepared.

4. Lighting aspects - visual comfort

We are going to measure day-light in specific zones of the hospital.
The aim of the monitoring is the evaluation of the illuminance and DF factor in zones in which daylighting was implemented by sun-pipes and roof-light.
We'll use a luxmetre to measure outside illuminance value and another one for internal monitoring.

Description of zones in which natural daylight will be investigated: patient room with two bedrooms, at the second floor. The room is characterized by two windows: one of them looks to the corridor and got natural light by sun-pipes.
We'll be also measured day-light in halls and rooms with facade on buffer zones and in corridors.

The measurements will be compared with results coming from simulation programme "Relux Professional".

LUXMETER HD 8366
Measuring range 0,1...200.000 lux.
Working temperature: 0...50°C
Storage temperature: -20...50°C
Humidity: up to 90% R.H.
Precision: ±6% rdg ±1% f.s.
(calibration with tungsten lamp type "A" 2850 K ±10K)
Temperature coefficient: ±0.08% f.s./°C

Figure1: Luxmeter

5. Thermal aspects - thermal comfort

Indoor comfort and microclimate conditions will be measured.

5.1 Indoor comfort

Measurements:

- Indoor Air Temperatures
- Indoor Air Humidity
- Surface Temperatures
- Air speed

We'll monitor indoor temperatures and relative air humidity in following zones: patient rooms exposed to north, south, west and east, buffer spaces and hall.
Instrument for RH and internal temperature is described in figure 2.
We'll also measure energy consumption during monitoring phase and results will be compared with calculation/simulation made during design phase.
Anemometer for spot-check measurements of air speed we'll be used.

www.geminidataloggers.com
Memory: 7900 measurements
Resolution: 8 bit
Battery Lifetime: 4 years
Logger interval: 1 sec – 10 days
Alarm: min/max
Delayed start: Yes
Trigger start: No
Temperature: -20 °C +85 °C,
Temperature sensor accuracy, : 0°C-50°C: ± 0.2°C
Temperature, logger resolution: 0.25°C at 0°C
Moisture: 0 – 95% RH
Moisture sensor accuracy: 3% at 25°C
Moisture, logger resolution: Better than 0.5%RH

Figure 2: Tinytag logger for measurement of indoor air temperature and relative humidity

Description of measurements

Besides, the following parameters will be monitored in different levels of detail for selected areas:

- Indoor air temperature
- Temperature of in-let air
- Indoor relative air humidity
- Daylight conditions
- Electricity use for lighting
- Air change (hybrid ventilation)
- Electricity use for hybrid ventilation
- Various parameters for the solar heating systems and domestic hot water
- Space heating
- Outdoor climate data (air temperature, relative air humidity, global solar insolation on a horizontal plane and in the same plane as the solar collectors, wind speed and wind direction)

Figure 3: Plan sketch of Meyer Hospital and Patient Room typology.

Values are logged every 30 minutes and one datalogger will be located in each of following zones (see figure3):

P1	Patient Room North oriented	H1	Hall West oriented
P2	Patient Room South oriented	H2	Hall East oriented
P3	Patient Room West oriented	H3	Hall South oriented
P4	Patient Room East oriented	R	Reception South oriented
BS	Buffer Space		

5.2 Microclimate

Measurements:

- Ambient Air Temperature
- Ambient Air Humidity
- Wind Speed & Direction
- Direct / Diffuse Solar Radiation

These data will be available from the nearest Meteo Station of Florence (in downtown) Observatory Ximeniano beginning from the continuous monitoring commencement date.
The Ambient Air Temperature and the Ambient Air Humidity will be also record by manual data loggers (one used for external temperature -figure 4, another one to measure external relative humidity-figure 5) used to collect outdoor microclimate in the continuous action from monitoring commencement date.

www.geminidataloggers.com
Memory: 16k (Non-volatile)
No. of Readings : 16000 (approx)
Resolution: 8 bit
Battery Lifetime: 5 years
Logger interval: 1 sec – 10 days
Alarm: min/max
Delayed start: : Relative / Actual
up to 45 days
Trigger start: Magnetic reed switch
Temperature: -40°C +85 °C,
Temperature sensor accuracy, : -40°C _ + 125°C
Temperature, logger resolution: : 0.4°C at +25°C

Figure 4: Tinytag Plus logger for measurement of external air temperature

www.geminidataloggers.com
Memory: 16k (Non-volatile)
No. of Readings : 16000 (approx)
Resolution: 8 bit
Battery Lifetime: 5 years
Logger interval: 1 sec – 10 days
Alarm: min/max
Delayed start: : Relative / Actual
up to 45 days
Trigger start: Magnetic reed switch
Temperature: -40°C +85 °C,
Temperature sensor accuracy, : -40°C _ + 125°C
Temperature, logger resolution: : 0.4°C at +25°C

Figure 5: Tinytag Plus logger for measurement of external relative humidity

6. Acoustic aspects - acoustic comfort

Acoustic comfort will be measured in details in the main front of Meyer Hospital.
Instrumentation: Sound Level Meter precision integrator of Class 1 according to IEC 651 (1979) and IEC 804 (1985)