Tele-monitoring of solar thermal passive and active designs

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1. SYNOPSIS

Tele-monitoring system with database management as procedure to transmit and to storage quantitative and qualitative data, from a data central collecting station to an enquirer outside station, using public telephone network.

2. INTRODUCTION

It is generally accepted that the primary aim of each solar thermal and energy conservation demonstration project is to improve ambient thermal comfort and/or reduce primary energy consumption. This can be achieved either by replacing conventional heat systems with solar systems, or by restructuring specific building or system parts which have an effect on heat-energy consumption or the containment of heat losses. The acquisition and evaluation of the main heat-energy parameters involving inside and outside temperatures, solar radiation, auxiliary energy consumption, indices of ambient thermal comfort....etc. , must be founded on criteria of simplicity, reliability and containment of operating costs. An attractive solution is a data acquisition system (DAS) connected via telephone lines to a computer PC-Station . The potential of the resulting services is extremely high; one need only consider that from an analysis observatory with just one computer Enquirer , one can control several projects even on line, perform the reading or programmed transmission of data either elementary (sensor input) or resulting from calculations in the datalogger, insert or change via telecomputing the heat-energy analysis programmes of a demonstration project wherever it is carried out. The analysis results are supplied whether on PC-screen or transferred on ASCII code so that they can be processed later with any editor program. The times for transmitting the data to the computer Enquirer installed in the analysis observatory are extremely short because all the data are previously stored in the computer PC - station and transmitted in block when required. Even the costs of transmission via telecomputing are low because the data transmission can be programmed in the evening or at night using cheap rates.

3. OBJECTIVES

The main scope of this tele-monitoring system have been the the following:

- to provide the Commission of the European Communities (CEC) - Directorat General for Energy DG XVII - Bruxelles, an innovative procedure for the control of THERMIE projects
- to give an easy and practical quantitative and qualitative remote checking of the energy yields of several THERMIE projects from a CEC observatory;
- to give easy and practical access to operators in the data bank of parameters which characterize the heat-energy functionality of a THERMIE project, and consequent assessment of the project itself (concept of Guarantee of results)
- a check of whether the project energy predictions correspond to the real situation.

4. TELE-MONITORING PROCEDURE

The overall concept of tele-monitoring system is shown in Figure 1, which illustrates the following key features:

- the project is fitted with monitoring sensors, which supply data to a Data Acquisition System (DAS)
- the DAS is connected - via modem - to a PC-Station Data Bank which processes the data, and stores it in an agreed set of files;
- the computer PC-Station is permanently connected to a modem, and hence to the public telephone network.

An enquirer connects hisor her computer PC-Enquirer via a modem, to the public telephone network, and obtains access to the data which has been stored in files on the computer PC - Station Data Bank.

4.1. Computer PC -Enquirer

The Computer PC -Enquirer has access to the Project PC - Station, and is able to:

- to see the data records on the PC screen
- down-load selected data files
- receive message from the Project PC - Station
- deliver message to the Project PC - Station.

It may also employ a commercial spreadsheet, charting package, or specialised software to manipulate the data, and prepare alternative presentations.

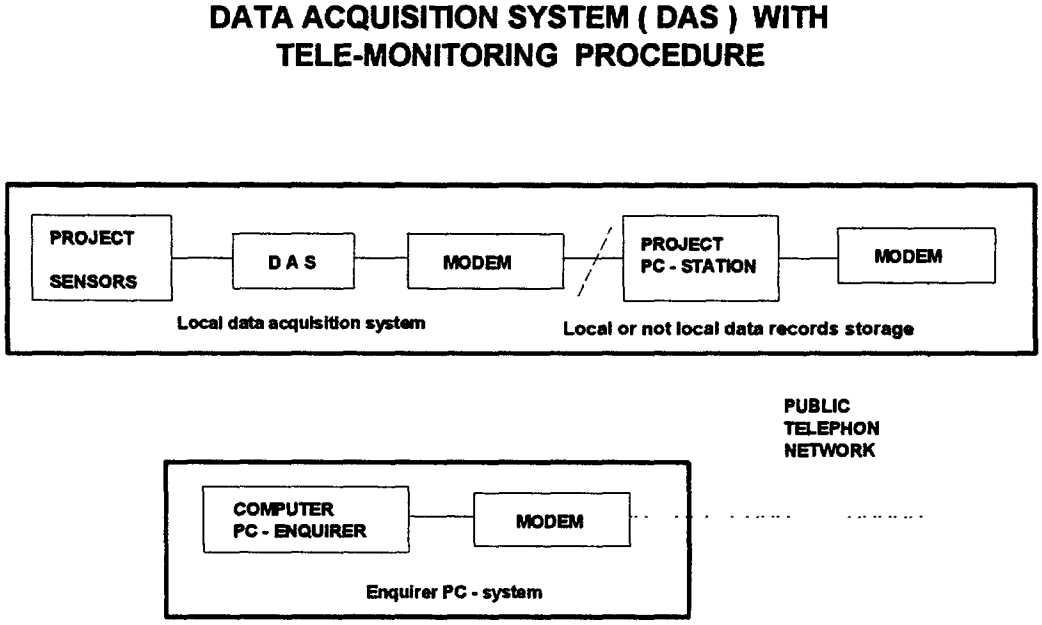

Figure 1. *Data Acquisition System (DAS) connected with tele-monitoring system*

4.2 Project PC-Station

The Project PC-Station should be set up to perform both data processing and communications at the same

time. The main tasks of the Project PC-Station are:

4.2.1 Task 1 - Data collection and processing

The project PC-Station, through the DAS receives the data from Project Sensors. The data will be processed (calibration factor could use hourly averages or totals produced,...etc.), and placed in files in ASCII format ready for transfer by tele-monitoring when required.

4.2.2. Task 2 - Control of tele-monitoring communications

The project PC-Station listen for calls from enquirers, check that they use the correct password and, if appropriate, offer them the options of viewing data on screen or of down loading complete files. It should also receive any messages sent by the enquirer, and hold them in a message area . Most Enquirers will have limited access to the Project PC-Station (controlled by the controlling system on the Project PC-Station), and will be permitted to read only a selected set of files.

5. SOFTWARD AND COMMUNICATIONS LINK

5.1. Transfer Protocol

Sending files one computer to another is one of must useful things you can do your modem. TELIX communications program for PC supports a full assortment of the most popular file transfer protocols, including Zmodem, Xmodem, Kermit etc. The work at the JRC Ispra has demonstrated that successful results can be obtained using the protocol Zmodem . TELIX needs be installed on the Computer PC - Enquirer

5.2. Passwords

Specific arrangements for the use of Passwords should be made between the project team and authorised enquirers, as necessary. These may be changed at agree intervals to meet security requirements.

6. RESULTS AND CONCLUSIONS

The tele-monitoring connected to the Solar House in the JRC-Ispra Solar Laboratory is now running with positive results.

In fact we have positively achieve the following objectives and results:

- tele-monitoring system installed use commercial devices (DAS, PC) without additional charges with exclusions of the modem device;
- telephones connections checking from several European towns and not last from several Italian towns have been easy, and the files capture (download procedure) fast and error free;
- the system is self-protected and consequently in case of black-out it can restart automatically without loss of data;
- the system is a good example for a simple tele-monitoring system, which is simple to use for checking the energy performance of the Thermie projects from a CEC observatory;
- it provide an easy access by the operators of the sector, allowing them to assess if the design energy predictions corrispond to the real situation (concept of the guarantée of the results);
- the access to the system is protected by a password released by the responsable of the installation and consequently it is assured any unintentional reading of data;
- continuous attendance of operating staff is not required.

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