Energy Data Analysis

Moving towards defence sustainable energy models

Background Description

Buildings consume approximately 40% of the energy in the EU. The great potential for saving energy lies in the field of low-investment measures, in particular for existing non-residential buildings. To this end, systematic methods like continuous in-service monitoring, energy data analysis and optimisation procedures as part of an energy management system need to be implemented.

The introduction of energy monitoring or energy management respectively is common practice to ensure or achieve energy efficient operation. Numerous examples from practice show that this is a valid method to achieve savings.

In practice, energy management is frequently limited to the weekly, monthly or even annual recording and analysis of energy consumption and its conversion to indicators, usually in connection with benchmarking. However, the continuous monitoring of individual consumption and its conversion into meaningful indicators is an essential part of savings in the field of energy-related costs. These complex tasks can only be performed with a specific energy management system.

Suitable energy management software facilitates the recording and analysis of all relevant data serving the evaluation of energy-related performance and energy efficiency.

Project Analysis

The implementation of the project includes the following five stages:

i. Benchmarking: an indicator system will have to be developed to support a time comparison, i.e. the development of energy efficiency, and a cross-sectional comparison, i.e. benchmarking in relation to other buildings/facilities.

ii. A monitoring system will be installed in the buildings/facilities. As a minimum standard, the data set listed below will be collected:

- Overall consumption (heating, cooling, energy sources, water);
- Climate (outdoor temperature and humidity, global radiation);
- Indoor climate (temperature, humidity, representative measuring points);
- System data (inlet and return temperatures, water circuits, air intake temperature, humidity of large ventilating systems). Data are recorded at least every hour (but as a rule every 5 or 10 min.).

iii. Once the monitoring system has been installed, the actual operational optimisation will be started. Initially, the data will be prepared, e.g. with tests, lumping, compilation, averaging, filtering or array. The prepared data will be displayed in standardised diagrams.

iv. Based on these graphs, data analysis algorithms for automated in-service monitoring will be implemented. From today's point of view, model-based fault detection and data analysis methods based on black box models have proved to be practical for this purpose.

v. To maintain the improvements that have been achieved, operations will continue to be monitored.

Objectives

The objective of this project is to define a uniform minimum data set and to collect energy data in fixed infrastructure as well as in operations with a high temporal resolution (<1h).

Standardised analyses will be developed to monitor the energy data flow in the buildings and to optimise energy consumption.

The practice-oriented data analysis methods will be adopted for extensive automation.

Impact – Expected Outcomes

Research on and the application of data analysis methods for fault detection and diagnosis as well as for the optimisation of energy management is a relatively new discipline.

The increasing interest is due to the fact that buildings are responsible for around 40% of the EU-wide energy consumption, and that solely by means of improvements during their putting into service and on-going operations, energy savings of between 5 and 30% can be achieved.

Opportunities

There is a unique opportunity to apply the same energy data collection approach on a broader scale: nation-wide and EU-wide.

The project is eligible for potential funding at European level, for instance, through the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the LIFE Programme.

Challenges

The biggest challenge lies not only with the implementation of proper energy command and control systems but also with the human energy behaviour change.

Methodologies

Energy management systems based on ISO 50001:2018 will be used as the basis for optimal use of energy management system together with advanced data metering, data collection and data analysis software solutions. It is expected that the project funding will come from both internal funding (from Ministries of Defence -MoD) and external one (EU funding).

Way Ahead

The proposed energy data collection solution can be extended to the other energy-based resource areas such as water, waste and fuel. Additionally, for more advanced energy data analysis artificial intelligence methods and systems will be designed and applied. However, this initial extension can be implemented after the successful implementation of this presented project.

The next steps related to this project will follow the project management and state-gate path: *after the initial international project consortia formation the international project originating team will prepare the updated and elaborated project idea documentation that will have to be approved by project consortia members.* The detailed project planning will depend on the availability of external funding.