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## ***Approach for the Improvement of Energy Performance of a Stock of Buildings***

### ***CSTB, Centre Scientifique et Technique du Batiment, ADEME, and Ministry of Equipment, France***

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#### **Summary**

This paper summarizes the work performed by CSTB<sup>1</sup>, ADEME<sup>2</sup> and the Ministry of Equipment in France to improve the energy performance of the ministry stock of buildings: 7 millions square metres, 10 000 buildings, wide range of different buildings of different sizes and uses. The project has four major phases: analysis of existing tools for energy performance evaluation, identification of the end-users of the tools and definition of a building typology, development of tools adapted to the end-users, validation and improvement of the tools. Since the building managers' motivation is an important factor to improve the energy performance of the buildings, the study has tried to incorporate the end-users needs and constraints in the different phases of tools development.

#### **End-user area**

- New buildings
- Refurbishment of buildings
- Transport and mobility
- Financial instruments
- Industry
- Legal initiatives (regulations, directives, etc)
- Planning issues
- Sustainable communities
- User behaviour
- Education
- Other

#### **Target Audience**

- Citizens
- Households
- Property owners
- Schools and universities
- Decision makers
- Local and regional authorities
- Transport companies
- Utilities
- ESCOs
- Architects and engineers
- Financial institutions
- Other

#### **Technical**

- Energy efficiency
- Heating
- Cooling
- Appliances
- Lighting
- CHP
- District Heating
- Solar energy
- Biomass
- Wind
- Geothermal
- Hydro power
- Other

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#### **Context**

In the setting of the governmental program for energy savings and its public buildings section, the Ministry of the Equipment in France promotes the policy of improving the management of its property holdings. For this purpose, CSTB, ADEME and the Ministry of Equipment in France are working together to improve the energy performance of the ministry stock of buildings: 7 millions square meters, 10 000 buildings, wide range of different buildings of different sizes and usages.

#### **Objectives**

The objective of the project is to gradually and continuously improve the energy performance of the ministry stock of buildings. To achieve this result we first need to help the managers of the ministry to evaluate the performance of their buildings, to give them information about the possible causes of under-performances and the different actions to be taken to improve their buildings performance. During the different phases of

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<sup>1</sup> CSTB: Centre Scientifique et Technique du Batiment

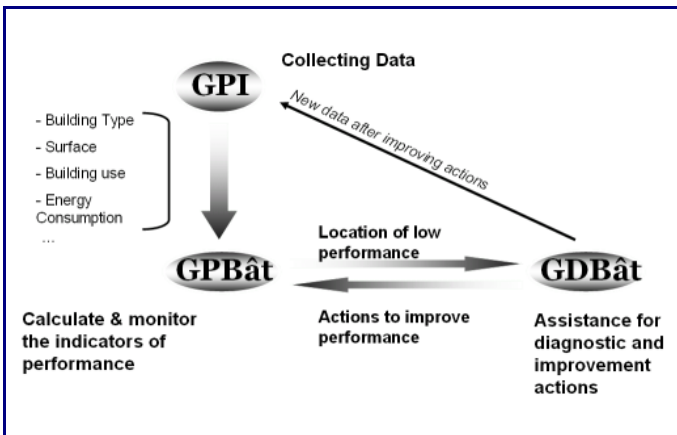
<sup>2</sup> ADEME: Agence De l'Environnement et de la Maitrise d'Energie



development we will tried to work closely with end-users in order to take into account of their needs and working constrains.

### Process

To improve the management of its property holdings, the Ministry of Equipment is collecting information about characteristics of its buildings and their water and energy consumptions. CSTB has defined a typology of the ministry stock of buildings based on their functionalities, usages, sizes, operating modes, energy uses, etc., and a methodology for comparing their performance (different indicators of performance with auto and inter-comparison procedures). Associated with these tools CSTB has also developed web-based tools to advise building managers of diagnostic and improvement actions. During all the phases of the project a close collaboration has been developed between local and central managers of the ministry to collect their needs and constraints and to adapt the tools to the end-users. Today we have started the phase of validation by using a preliminary set of collected data and with the collaboration of a group of managers.



**Figure 1.** Relation between three tools: GPI, GPBat and GDBat

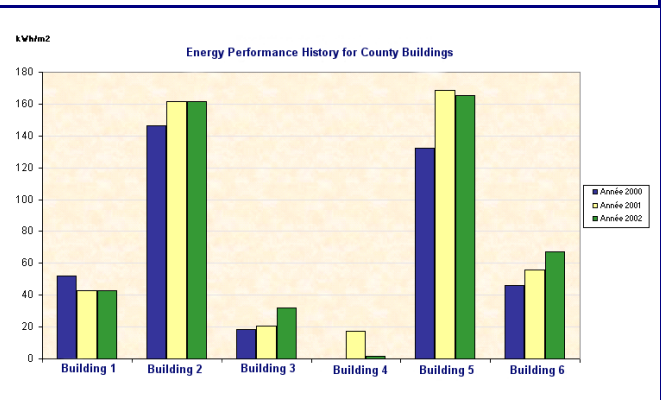
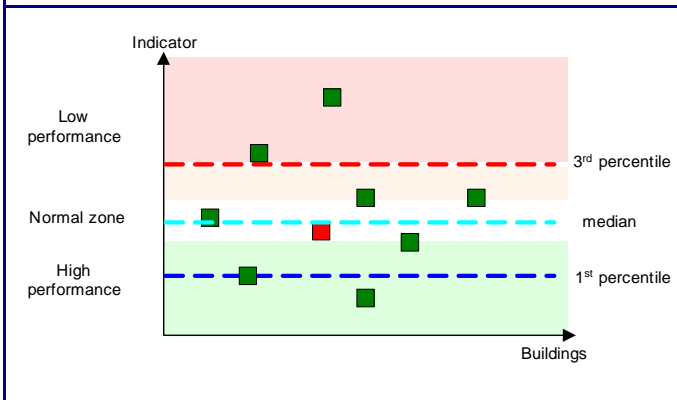
**Figure 2.** Photos of four types of buildings of the ministry

GPI: the tool developed by the ministry to collect and manage information about its stock of buildings

GPBat: the tool to analyze the energy performance and water consumption.

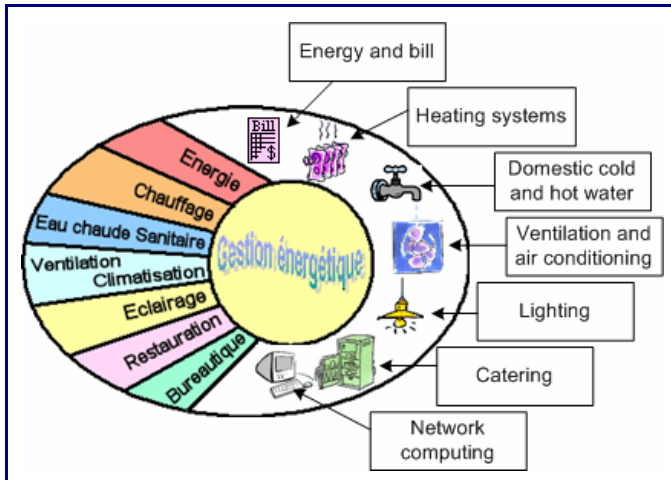
GDBat: the tool to help for diagnosis and to develop improvement actions.

The comparison of the indicators with reference values helps the manager to evaluate the energy performance of its buildings. However the reference values are defined for a family of buildings with similar characteristics. To define the families of building for the ministry a typological study needs to be done.



**Figure 3.** Graph for buildings performance comparison with low, normal and high zones

**Figure 4.** Graph for analyzing the history of the building performances



**Figure 5.** First window of GDBat with the different items to refer for improving the building performance

**Le chauffage**  
Améliorer le confort, le bâti, l'installation de chauffage, réduire les coûts

**Introduction**

**Confort**  
Les usagers sont-ils satisfaits ?

**Installation**  
L'installation de chauffage peut-elle être améliorée ?

**Dépenses**  
Les coûts peuvent-ils être réduits ?

**Menu Installation**

Quelles anomalies constatez-vous ?

- Fréquentes pannes
- Démarrage et arrêts fréquents de la chaudière
- Programmation trop lourde à gérer

Ce qu'il est possible d'améliorer :

- Le rendement de la chaudière
- La régulation de la chaudière
- Le réseau

[Les prestations d'entretien](#)

**Figure 6.** Heating system improvement approach

## Financial resources and partners

The budget of the project is 70 000 € and shared as follow:

- CSTB: 40%
- ADEME: 40%
- Ministry of Equipment: 20%

## Results

The tools developed for the project are today implemented in the Intranet of the Ministry of Equipment in order to make them available inline for all local and central managers of the Ministry.

Today, we do not have the estimation of the gains but a specific function implemented in the GPBat (tool for analysing the energy performance of buildings) will help end-users to estimate directly their energy gain in €, €/m<sup>2</sup>, kWh/m<sup>2</sup>, €/occupant, kWh/occupant.

## Lessons learned and repeatability

This paper presented our approach in developing tools to help building managers to improve their buildings energy performance. The work during the different phase of this study was done in close collaboration with end-users, who are not experts of building operation and that task of management is an auxiliary task among their different duties. We have tried during the development phases to find solutions that can motivate end-users and meet their needs and working constrains. For example:

- For the building typological approach, we developed a typology based on the ease of identification and the usage of the sites (groups of buildings) rather than a typology based only on purely statistical and administrative information;
- For the tools, we produced an easy-to-use system with a hierarchical approach that gives the possibility to the end-user of defining the level of details he needs to access.

The validation phase with end-users has led to the simplification and more automatic configuration of the tools so that they will be more efficient for the managers to use.

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