Energy Management

MONTPELLIER (France)

Montpellier has been a pioneer in the field of energy management. This French city now takes advantage of 25 years of expertise and an exemplary organisation that facilitates the coordination of the transversal initiatives launched by the Energy service.

THE CITY

Twice in its long history, Montpellier has risen in prominence to acquire metropolis-status. In medieval times, Montpellier was the second city in the Kingdom of France and opened trading posts in Tyr, St-Jean d'Acre, Tripoli and even as far away as Armenia. In the 18th century, Montpellier went on to become the king's provincial and administrative capital of Bas-Languedoc. Today, with its 265,000 inhabitants, the capital of the Languedoc Roussillon - region occupies eighth place in the rank order of French cities.
Since the 1970's, Montpellier has been very dynamic in its development of ambitious town planning projects, such as the redevelopment of the Antigone district. Montpellier is also a growing economic centre specialising in research and advanced technologies.

CONTEXT

Montpellier is recognised as a pioneering city in the field of management and rational use of energy. Montpellier is, for example, the first city to have used remote energy monitoring systems to monitor the consumption of some of its most energy-consuming buildings. It must be said that the city council has to look after an important property estate as well as a number of energy installations: 350 heating systems, of which 170 are monitored by means of remote monitoring systems. It is also one of the few French cities to have and to develop a heating and air-conditioning network. Extending across 15 km, this network supplies the equivalent of 5,760 homes with heating and the equivalent of 1,800 homes with cooling in the Antigone district, which is situated to the East of the historic town centre. For 20 years, the town hall has served as a real-life laboratory for the application of DSM (demand side management) concepts.
Since 1985, when the energy service was created, technicians have been measuring and analysing energy consumption throughout all municipal buildings. The energy service is responsible for the design, operation and maintenance of energy installations, together with the monitoring of energy consumption in all municipal buildings. The results of this work – which makes it possible to make informed decisions concerning thermal retrofitting works, energy transfer and tariff optimisation – are very far-reaching. In fact, energy consumption per square meter in constant € has decreased by 53 % between 1985 and 2010.

In November 1996, the DEMT (*Direction Energie Moyens Techniques – Energy and Engineering Department)* was created in order to carry out horizontal projects for all the municipal and affiliated services (CCAS (*municipal social services)*, organisations belonging to the district of Montpellier).

EXPERIENCE OF MONTPELLIER

Historical background

A strong political impetus has been the starting point for the initiatives that have so far been launched in the domain of energy in Montpellier. In fact, 1979 saw the beginning of a permanent commitment: the mayor decided to create a municipality-controlled company for the maintenance of heating systems. In 1983, a post was created for a council delegate for energy management. In 1985, the municipal services underwent a major reorganisation that was conducted by the Chief Executive Officer. This was how the energy service came into being. The latter has its own budget. For the last 25 years, it has fulfilled its three objectives of planning, implementation and management of energy initiatives with a horizontal approach across all the municipal services. It implements the energy policy that is defined by the members of the council, with the essential aim of ensuring overall consistency of costs between investment and running costs.

Organisational Structure

The organisational structure for technical services was modified in 1996 with the creation of a new management department: the DEMT (*Direction Energie Moyens Techniques – Energy and Engineering Department)*. This key position – in direct line with an important department – places its director in an excellent strategic position in his relationship with the other municipal departments. This organisation enables the DEMT to fulfil more easily the transversal objectives between the different municipal services.
The director of the DEMT manages a staff of 94, who work in four services:

- Energy (37 staff),
- Buying and printing service (33 staff),
- Geographical Information (7 staff),
- Municipal vehicles (17 staff).

The energy service comprises three distinct entities: a research department (3 technicians), an energy and water monitoring unit (3 technicians) and the heating system maintenance unit (18 staff, of whom the majority are heating technicians).

The objective of the energy service: upwards and downwards

By means of its horizontal approach, the energy service cooperates with all municipal services, with the support of the deputy mayor delegated to energy management. The three specific objectives for which it is responsible necessitate quasi-permanent links with the other municipal services.

1- The design of new buildings

The energy service is involved in building design projects on a number of levels (both in terms of the building itself and the energy installations). It acts as project manager in cooperation with the other services and produces “heating” specifications for all on-going projects: technical specifications and bills of quantities. It produces an "energy performance sheet ", which is used in architectural competitions.
It can happen in the case of larger projects, such as the construction of the central municipal library, that a consulting firm takes responsibility for the preparation of specifications. However, any such input is monitored by the research department of the energy service.

2- Heating system supervision and management

This day-to-day work necessitates contacts with all the municipal services.

3- Energy consumption monitoring

The energy service has progressively developed tools and expertise that enable it to gain an excellent awareness of municipal buildings (surfaces and volumes to be heated and lit), of their installations (number of heating systems, capacity installed, age…) and total energy consumption over several years for the different items (heating, electricity in buildings, public lighting…). The 590 supply points are managed by the energy service. These amount to almost 2,400 bills that are processed every year.
The energy service designs management charts in order to measure and compare the energy performances of the installations for which it has responsibility.

This involves:

- Energy monitoring processes: the follow-up of energy consumption of an installation from one week to the other and from one year to the next,
- An annual statement that takes into account new developments in municipal buildings (increase or decrease), the price index, the climate,
- Benchmarking: comparing its energy performance with that of other towns by means of specific ratios,
- All of this assessment and analysis work (monitoring) is conducted by means of energy monitoring on office EXCEL.

Transversality on a daily basis: resources and results

The quest for information

The energy service is required to become involved at as high a level as possible in all design projects for new buildings. The aim is to raise the awareness of all involved in the project - programmers, architects, research departments – of the importance of the chosen source of energy, which is an intrinsic element of the cost of investment and the cost of implementing the project: this approach helps them to think in terms of global costs. In order to achieve this, the energy service is consulted by the other municipal service(s) in the first instance. In Montpellier, the energy service sometimes anticipates this consultation by carrying out a proper **project overview** by checking the initial budget and the supplementary budget. This anticipation enables the energy service to be both more reactive and more pertinent in its response.

The information circuit

In the city of Montpellier, the exchange of information between the energy service (DEMT) and the other municipal services frequently occurs by means of informal communication. This informal approach can be explained by the working routines and the relationship of trust that has existed for more than 25 years between the energy service and the other municipal services. However, formal communication does exist due in particular to the circulation of memoranda and the organisation of meetings devoted to specific themes.

Memoranda

Every year, all directors, heads of services and municipal company managers receive two memoranda signed by the Chief Executive Officer. The first, entitled "Low energy buildings: programme elements for optimum energy comfort in council buildings ", is also sent to all external partners in the building trade, who are involved in any new municipal building or retrofitting projects. This memorandum focuses on energy-related factors, particularly the objective of optimising the dimensioning of installations and the choice of materials at planning stage.
The other memorandum is circulated exclusively to the directors, heads of services and municipal company managers. It consists of two sections:

- A text that highlights practical elements, such as the telephone number of the on-duty team, in the event of an anomaly becoming apparent within the installations, regulatory requirements (maximum temperatures, the submitting of written requests for school buildings to be heated outside of the normal periods),
- A graphic representing energy costs for the current year per type of energy.

The advantage of these two memoranda is that they are concise and clear. They are circulated by the highest level of management (the Chief Executive Officer), which reinforces their legitimacy and their importance.
This practice, which began in 1995, is well received by the addressees, who have become information requesters.

Statements annotated by management

At the beginning of each year, the manager of the energy service sends to all directors and heads of services a personalised summary chart showing the energy consumption of the buildings for which they are responsible. A graphic indicates the energy consumption measured since 1987, with information concerning the commissioning of new buildings.

Coordination

Once per year, all the council departments meet to assess the progress of building projects and renovation work of the year n+1. This meeting provides an opportunity to coordinate the input of different teams belonging to different services at the same site.

Activity Report
Each year, a detailed report describing the activities of the energy service is published. This document is an initiative of the energy service and has two ultimate objectives: to take account internally of the work carried out in the past year and to keep informed the other local authorities, with which the town of Montpellier has formed a network for the sharing of experience and expertise. This report includes a presentation concerning:

- Directions taken in the energy policy of the city,
- Commented statistical consumption data (over a period of several years),
- Information communicated by the service using various media (memoranda, press releases and reports on TV).

The "energy" management chart of the town indicates consumption data for the period of 1985-2010.

Networking
The city of Montpellier has been an active member of the group *Ingénieurs des Villes de France, AITF* ("Engineers of French Cities") since its creation in 1985. It is also a member of specialist networks of cities: '*AMORCE'* (concerned with the topic of "waste") and 'Energy-Cities' (concerned with "energy and municipalities in Europe"). This networking facilitates especially the sharing of good practice.

A dedicated section on the website
The wider public is kept informed and made aware of energy management by means of the "sustainable city" section on the city's website: www.ville-montpellier.fr**.** The theme of energy is divided into 6 sections that are devoted to the initiatives of the energy service and give practical advice on methods of saving energy on a day-to-day basis. The website also features a game that gives readers an opportunity to test their knowledge in question and answer form. The sections are as follows:

- An active energy-saving policy,
- The heat and cooling network,
- A plan for public service vehicles,
- It is possible to economise,
- Do the right thing.

EVALUATION AND OUTLOOK

The town of Montpellier has been consistently applying the same energy efficiency strategy since the end of the 1970's. This strategy is reflected in the current organisational structure of the municipal services. It places the Energy director in a strategic position, so that he is able to coordinate and represent its transversal objectives with the other municipal services. The information circuit is simplified as a result, as it is the energy service that centralises information and organises its circulation.
Transversal links form the basis of the work of the energy service, whose main purpose can be summarised in three key words: to keep informed, to inform and to anticipate.

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This case study was prepared by Energy-Cities in co-operation with the Energy Service of the city of Montpellier.
First publication in 2003 with the financial and technical support of the French Agency for Environment and Energy Management (ADEME)

MEMORANDUM FROM THE MAYOR TO HEADS OF DEPARTMENTS

Subject: heating and energy use in municipal buildings

Please find below a reminder of a few measures to be taken relating to heating, cooling, lighting and power supplies to equipment and facilities that come under your sphere of responsibility:

1) In the event of faulty operation, a team is available during working days from 8 a.m. to 12 a.m. and from 1:15 p.m. to 5 p.m. ***They can be contacted by dialling 04 67 34 73 55.***

2) Outside these periods and in the event of a serious failure, an emergency team from the Energy Department may be contacted any time on ***06 08 41 00 72 –*** *Call the fire brigade if you can only make local calls using your line. The emergency team can only deal with mechanical failures in heating and cooling systems. Any other problems (such as vandalism, electrical failures, lighting problems etc.) must be reported to the fire brigade who will contact the Duty municipal engineer.*

3) In buildings equipped with hot water central heating systems, ***backup electric convectors are, as a general rule, not allowed*** *for safety reasons (fire hazard caused by the use of wall sockets that are not intended for this purpose). This means that* ***all equipment installed without the written consent of the Energy Department will be automatically removed and you may be held liable for any accidents that occur as a result of its use.***

4) Maximum permissible heating temperatures are as follows: gymnasiums: 14° - schools and offices: 19° - crèches: 21° (a 1° increase in room temperature would result in a 20% increase in the cost of heating a gymnasium and in a 10% increase for schools and offices). In summer, the cooling temperature is to be set to 26°.

5) We would like to draw your attention to the amount of ***electricity that is being used annually; this accounts for two-thirds of the total energy expenditure on municipal buildings.*** *I would ask you to be vigilant, in particular with regard to lighting, and to check that lights are all turned off when the buildings are not occupied. In order to reduce the amount of electricity being used for lighting purposes, the Energy Department is gradually replacing all incandescent and halogen lamps with fluo-compact lamps that use five times less energy. I ask you to do your utmost to assist them in their task.*
By the same token, I would like you to check that all fan-convectors, refrigerators, cold chambers mechanical ventilation systems and electric water tanks are switched off during the holidays, and to switch off computer monitors and printers when they are not being used, even for short periods (one hour or more) as well as central computer units during week-ends, public holidays and vacations (or even at night wherever this is possible) in order to avoid wasting energy.
May I take this opportunity to remind you that ***modifications to the contract with utilities and any requests for new connections are to be made by the Energy Department (tel.: 04 67 34 59 57).***

6) The heating of school premises on a regular basis outside normal heating periods will only be granted in exceptional circumstances and on condition that an ***agreement has been signed between the association involved and the municipality.***
For exceptional occasions (such as bingo games etc.), a written request signed by the head of the department concerned must be sent to the Energy Department at least 15 days in advance.

7) As for building or renovation projects involving municipal buildings, a document with all the energy saving regulations in force can be obtained from the Energy department (low energy buildings).

In view of the significant energy bill involved, which came to 2,2 million Euros for municipal buildings in 2010, I thank you in advance for your help in fighting wasteful behaviours.

MONTPELLIER
Flagship initiatives for an energising energy policy

Ville de Montpellier
Direction Energie Moyens Techniques
Service Energie

1) Optimisation of the energy design of equipment

The objective of the City of Montpellier is to provide a comfortable environment for users at the lowest possible cost. This involves taking the overall cost of a building into consideration, which means not only construction costs but also all the operating cost for its entire life.
In order to achieve this aim, the Municipality of Montpellier has since 1995 been publishing a memorandum from the Chief Executive Officer, Mr Jules NYSSEN, addressed to all the stakeholders involved in the design and construction of municipal buildings. It includes, amongst other things, specifications relating to thermal insulation, heating techniques, lighting and summer comfort in buildings.
These specifications are also integrated into construction programmes for new equipment and are critical criteria in the selection of potential contractors. In addition to this, a dynamic simulation of the thermal behaviour of some of the larger facilities (such as the future City hall) has been performed using computer software which integrates meteorological data. This proved to be of use in identifying the weak points of buildings and in forecasting the financial impact of the improvements that were proposed.

⇒ **Results in figures**:
- In a recently built school the cost of heating and lighting per m² of floor space is almost half the cost for older schools

2) Electricity-demand management

In 1987, a survey of the energy expenses for municipal buildings was carried out. It concluded that nearly two-thirds of total energy expenditure for municipal buildings was associated with electricity consumption.
Measures were then introduced to reduce energy bills. The measures taken included:
- Tariff optimisation for all electricity supply contracts
- The installation of energy efficient lighting in all buildings
- Removal of electrical heating systems and their replacement with hot water heating systems
- Upgrading of existing pumps and fans
- Minimisation of cooling requirements

⇒ **Results in figures**: in spite of the fact that the stock of municipal buildings had increased by 20,2% and that electricity prices had remained stable over the period involved, between 1987 and 2010 the municipality achieved the following results :
- Subscribed demand reduce by 7,0%,
- Annual consumption was reduced by 16,4%,
- The annual reduction in expenditure amounted to 7,6%, i.e. €107,000 (including VAT)

3) Strict management of energy expenditure for municipal buildings

Since 1986, all utility bills for municipal buildings have been centrally processed in the Energy Department, which is responsible for inspecting the bills and checking them for invoicing errors, for monitoring consumption for each building and for optimising the individual utility contracts.
Daily monitoring of heating consumption is performed by means of a remote boiler-room management system to which 170 heating installations, responsible for 80% of total energy consumption, are being connected.

⇒ **Results in figures** (data obtained from administrative accounts):
- between 1985 and 2010, energy expenditure for municipal buildings, in constant euros and corrected to a constant level of building stock, fell by 53%, corresponding to an estimated cumulated 44,5 million € savings in expenditure on energy, in comparison with what this expenditure would have been if no measures had been introduced since 1985 (see picture and figure).

4) Use of renewable energy sources (RES) in the new City Hall

On 24th September 2002, the City Council of Montpellier approved a construction programme for the new City Hall. Optimisation of the energy design of the building was a critical factor in the selection of tenders, as was the ability of the building to generate electricity through 1,300 m2 of photovoltaic panels, thus meeting a significant proportion of its energy requirements.

For nearly 200 years, mankind's advancement has depended essentially on the thoughtless use of finite energy resources, whether from fossil or nuclear sources. These sources were created over millions of years and are, for the most part, now almost exhausted. They represent a source of pollution, of conflict and, because of their uneven geographical distribution, even of wars.

Through the construction of the new City Hall, it is aimed to demonstrate that it is possible to build a comfortable yet energy-efficient building and that clean locally produced energy, which is a source of peace, can be used to cover a significant proportion of the building's energy requirements. For decades to come the City Hall of Montpellier will stand as an example of the gradual increase in the utilisation of renewable energy.

5) Montpellier's heating and cooling network (RMCF)

In 1986, the municipality of Montpellier decided to build a heating and cooling network to serve two new districts, Polygone and Antigone. Heat was to be generated by a gas- and coal-fired boiler and cooling produced using absorption chillers.

In 1996, a CHP (Combined Heat and Power) unit equipped with gas-fuelled engines was added to the network. The RCMF concessionaire sells the electricity that is generated locally to EDF and feeds the heat produced into the network. In 2000, a tri-generation unit fuelled with natural gas was commissioned which produces heat, cooling and electricity.

⇒ **Results in figures (year 2001)**

♦ Electricity output	33,4 GWh
♦ Heat production	73,5 GWh
♦ Cool production	37,3 GWh
♦ Number of dwelling equivalents connected to the RMCF	Heat: 6,500 Cooling: 2,500
♦ Power requirement from connected installations	Heat: 63 MW Cooling: 35,9 MW

6) Clean transport systems

In July 2000, a light rail (tramway) line was commissioned. The route runs across Montpellier from the North-West to the South-East, with 28 intermediate stops along its 15.2 km length. Coaches run by the *Département* Council and buses from the city's public transport operator *"Transport de l'Agglomération de Montpellier"* (TAM) connect with the tramway line at interchange stations that have been designed to provide connections using the same platform.

This reliable, fast and pollution-free mode of transport is contributing to limiting the increase in the number of journeys made by car, and therefore of the fuel consumed as well as CO2 emissions. A second 21 km line has been launched and should be complete by 2006. A third line to connect the city with the sea is in the pipe line (year of completion: 2008).

Since 2000, TAM has bought 70 NGVs (natural gas vehicles), and these now account for more than half their fleet. In 2012, the entire fleet will be running on natural gas.

The same approach was adopted by the Municipality of Montpellier for its own fleet of vehicles (60 vehicles are running on clean fuels; natural gas or LPG) and for the collection of domestic solid waste. In January 2002, 11 collection trucks running on natural gas and 6 small trucks with a dual fuel system (electricity and LPG) were introduced.

The City has also developed 137 kilometres of cycle paths and TAM has introduced a bicycle hire service. (1700 units).

7) Creation in 2007 of the Local Energy Agency of Montpellier (intelligent energy program of the European Commission, with the supply of Energy-Cities).

8) Covenant of mayors in 2009

Montpellier was one the first European cities signatory of these important action between local territories and the European Community.

9) And in 2011 ?

- Montpellier has decided to build two news schools with a new concept : BEPOS ; theses passive buildings will consome less energy than they produce, with photovoltaic system,
- PCET : launching with 3 local communities around Montpellier of a local energy and climate plan.