

Review of good practices in measuring and verifying energy savings among French energy efficiency services actors – a strong will to put quality securing methods forward

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Abstract

The Energy Efficiency Services Club (Club S2E) was founded on November, 5th 2005 by five French main actors in the field (professional associations: FG3E, SERCE, GIMELEC, UCF, UFE), with the support of the French Energy Agency, ADEME. The Club aims at forming a working group to contribute to the energy efficiency market development. As a first task the Club agreed on common definitions and further to establish common practical references. Through ADEME a connexion is formed with the “EUROCONTRACT project”, a European Platform for the Promotion of Energy Performance Contracting (EPC). In order to propose a French vision of good practices and to ensure the integrity of EPC, the Club has led a study on “measurement and verification methods and tools for assessment of energy efficiency improvement or of energy savings obtained within the framework of an Energy Performance Contract”.

The study realises a two-fold benchmark: a first part based on an expert review of American and European standards, tools and methods, with a description of the market they address, and a second part using interviews with experts employed by members of the Club. After this state-of-art, the technical-economical conditions for use of these tools and methods in France on each sector (households, commercial buildings, industry) will be explored with the aim to propose a methodology based on best practices.

Introduction: state of the French market in Energy Services

ADEME is a partner of the Eurocontract project, a European Platform for the Promotion of Energy Performance Contracting (EPC), and is particularly involved in contributing to the objectives of Eurocontract in France. As a first contribution, ADEME portrayed the French situation for energy services in a “country report” which is summarized hereafter.

THE DOMINANT ACTORS OF ENERGY SERVICES

Till now one model of energy service is dominating the French Market; this model is historically based on operation and maintenance contracts for boiler houses and building heating. It was first initiated in the public sector and, after this first experience, came into general use in the private sector. Some of these contracts comprise guarantees for savings and performance as explained further.

This traditional market is characterized by a strong concentration of actors, three of them are particularly dominating the market: DALKIA, ELYO, COFATHEC. Each of them is linked to one of the three main energy utilities in France (EDF, SUEZ and GAZ DE FRANCE).

Apart from these main “Energy Efficiency Services Companies”, new actors offer new services:

- *Energy suppliers*: facing the liberalization of energy markets, they developed skills to become multi-energy suppliers and services providers. At the moment such services consist in advice for energy use, energy audits, load curve analysis. The large suppliers (EDF, SUEZ) tend to develop new offers

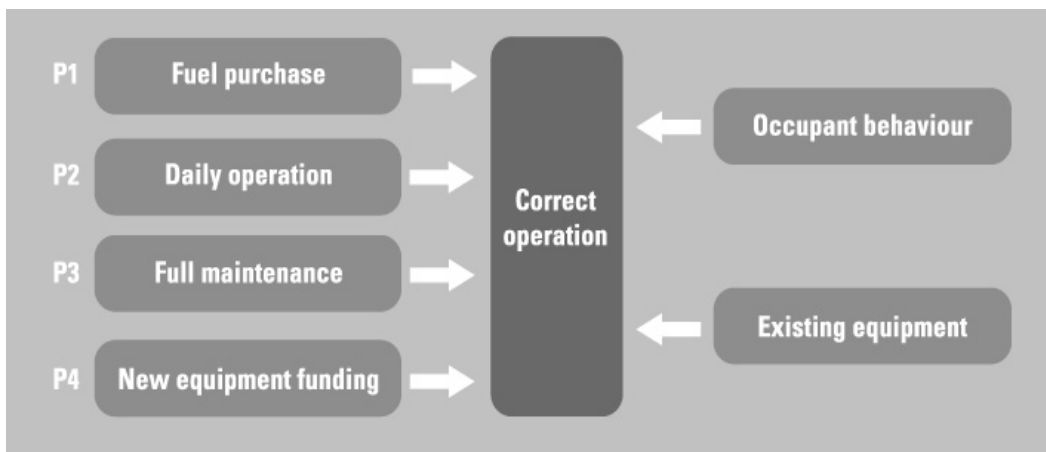


Figure 1. Breakdown of a typical HVAC Public Contract

based on energy services, including guarantee of results (e.g. a level of energy savings) on all kinds of energy uses.

- *Large facility operators*: companies like CEGELEC, AMEC SPIE, VINCI provide services (mainly on buildings) in competition with traditional HVAC operators, whether directly or through subsidiaries.
- *Equipment suppliers*: actors like SIEMENS, SCHNEIDER ELECTRIC, JOHNSON CONTROLS provide EPC in France. For these new-comers the business is just starting.

A DOMINANT APPROACH INFLUENCED BY THE PUBLIC PROCUREMENT CODE

French law strictly frames public contract processes. In particular, it settles a framework for HVAC contracts within two reference brochures: CCTG n° 2008 “Operation” and n° 2008bis “Heavy maintenance”. According to these documents, operational contracts related to heat distribution are split into four different items:

Cost consist in energy cost for the part P1, manpower and current maintenance costs for the part P2, heavy maintenance and global warranty costs for P3 and investment amortization for P4. This typology crossed the framework of public contracts as a model for most of Energy Performance Contracts to become a reference also for private contracts. These different parts of operational contracts will be discussed more in detail further on. This classification, rather practical, has had a beneficial effect on energy services development in France.

The federative approach in EPC proposed by the S2E Club

WHAT IS THE S2E CLUB?

The Energy Efficiency Services Club (Club S2E) was founded on November, 5th 2005 by five French main actors in the field with the support of the French Energy Agency, ADEME. It gathers professional associations:

- FG3E, French Federation of Firms offering Services dealing with Equipment, Energy and Environment

- GIMELEC, Group of Firms manufacturing electric equipment, control and related services
- SERCE, Union of Companies dealing with electrical engineering
- UCF, Union of Companies dealing with environmental engineering, as a part of the French Federation of Building
- UFE, French Union of Electricity, Professional Association of the electric sector.

The Club aims at forming a working group to contribute to the energy efficiency market development. It is intended as an information media towards persons interested in the energy management of buildings and industrial utilities. It watches national public policies, and allows the French Energy Efficiency Service companies to express a common position and recommendations towards French and international institutions. The Club is going to publish a Guidebook, in cooperation with ADEME. The following definitions and descriptions are extracted from this Guidebook which the reader should refer to for more detail.

ENERGY SAVINGS AT STAKE

Energy Performance Contracts (EPC) address both commercial/administrative buildings and industrial utilities.

Buildings (households and commercial) are the largest energy consumers in France, representing 46 % of the energy consumption. During the last 30 years, the energy consumption in buildings has risen by 30 %, with an even stronger increase for commercial buildings: 32 % in 17 years. The forecasts are following the same trend. Applying a combination of new technologies and innovative contractual solutions would allow realising important potential savings.

Having concentrated their efforts on their production processes in the past, the manufacturers now get interested in cost reduction in the field of utility production and distribution. The effect they seek is an enhanced global productivity.

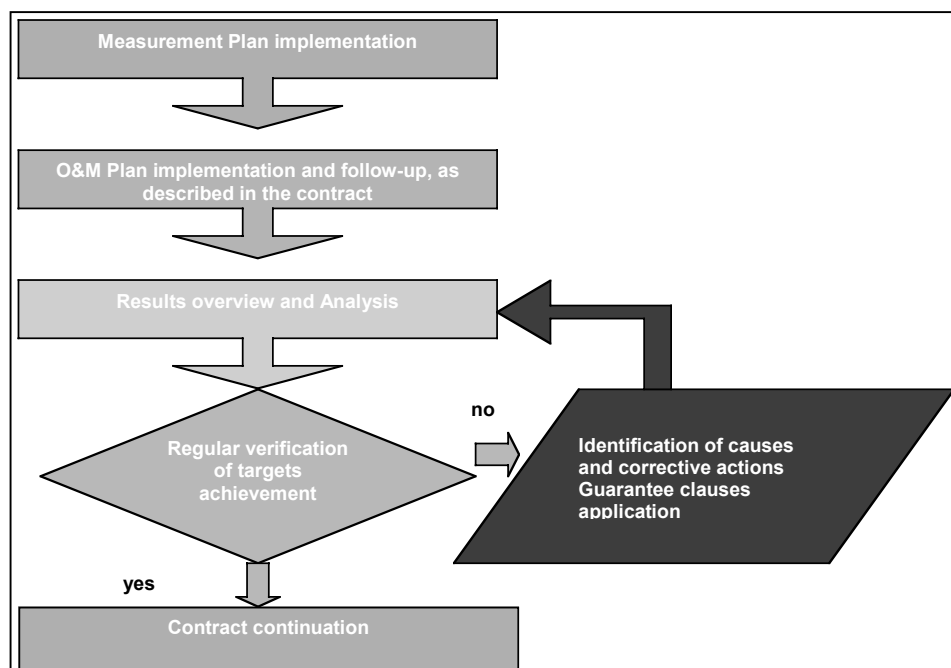


Figure 2: description of the different steps in phase 4 (follow-up and performance guarantee phase)

A COMMON DEFINITION FOR ENERGY EFFICIENCY SERVICES

As a first task the Club agreed on common definitions and further to establish common practical references. Energy Efficiency Services are defined as follows:

“The implementation of actions (equipment, works and/or services) leading to an improvement of energy efficiency associated whenever applicable with renewable energies.

The improvement or saving brought to the customer must be measurable or verified or else estimated in the case when measuring is not adapted.

The contractor gives a guarantee of result in energy efficiency improvement and commits himself by contract to:

- Characterise accurately the reference situation,
- Implement means of performance control and measurement,
- Reach the objectives in terms of quality and energy savings announced.”

A METHODOLOGICAL FRAMEWORK

The methodology developed in the Guidebook presents the necessary steps to manage an energy efficiency service project. It can be adapted in content and organisation according to the characteristics of the project as well as the type of customer (public/private). It comprises four essential phases:

- A pre-audit phase
- A proposal elaboration phase
- A work realisation phase
- A follow-up and performance guarantee phase.

According to the Guidebook, EPC must include economic clauses regarding measurement, energy efficiency calculation

and verification methods. The service begins with a preliminary phase consisting in measurement instruments installation and the verification of the whole set of meters. Energy savings M&V actions take place principally during phase 4, as described in the Guidebook:

French partnership with the EUROCONTRACT Project

The objective of the Eurocontract project led by the Berliner Energie Agentur, is to contribute substantially to the acceleration of the market for energy services in Europe by further development of Energy Performance Contracting Schemes in Europe. Focussing the action on this topic will help to achieve tangible results which are described in the Directive on End-use Energy Efficiency and Energy Services and in the Directive on the Energy Performance of Buildings.

This project focuses on using the legislative framework at EU, national, regional/local levels in combination with dissemination to build knowledge and to increase implementation of market instruments for innovative energy services. The chosen approach is to build a Central Platform for exchange, to aggregate know-how, to provide and further develop the tools, fostered through training multipliers and involving market actors.

One of Eurocontract objectives is to federate the different actors supplying energy efficiency services; the Club S2E is now the place where these actors can work together on common subjects such as models of procedure for tendering process, or definition of a common methodology for measuring and evaluating the energy guarantees of EPC. All this will contribute to securing the contracts and so to further develop the EPC market in France.

The Club S2E, as a support partner of ADEME within the Eurocontract Project, has contributed to an investigation pi-

loted by an Austrian partner of Eurocontract (Grazer Energieagentur) about quality standards, certification issues for EPC and innovative energy services.

The majority of the Club members consider important the certification of Energy Service Companies (ESCOs), still the certification process must require low effort from the ESCOs; in general the energy savings guarantee is a quality securing instrument that can be proposed in the contracts of the different ESCO associations. The White Certificates mechanism which is now implemented in France is considered as helpful to bring energy services into the market.

Measurement and verification (M&V), the heart of an EPC

A CONTRADICTION REQUIREMENT

Measurement and verification of energy savings is a key-topic in Energy Performance Contracts and leads to a paradox:

- On the one hand, how could the customer place his confidence in the contractor without concrete dispositions in order to check and control the energy efficiency improvement, object of the contract? It is well-known that “you cannot really manage what you do not measure”...
- On the other hand, the cost of an accurate measurement campaign or of a permanent monitoring is often seen as unaffordable by the customer...

AN ACKNOWLEDGED KEY-FACTOR FOR THE DEVELOPMENT OF EPCS

In Europe, a moderate success for EPCs has been observed in a study called “Energy Service Companies in Europe - Status Report 2005” led within the framework of the European Joint Research Centre (P. BERTOLDI and S. REZESSY). This study states that “although the European Commission and the Member States of the European Union have supported a number of policy initiatives to foster the ESCO industry, a recent survey of ESCO businesses in Europe has indicated that major differences exist in the development of the ESCO business among the various countries”

In chapter 6. **Barriers to energy performance contracting**, the authors analyse the reasons that “inhibit the wider deployment of development of EPC and development of ESCOs”; among many reasons we find:

- “Low awareness, lack of information and scepticism at the demand side of the market for energy services because energy savings are “not seen” [...]
- Measurement and verification protocols for assuring performance guarantee are not understood”.

In chapter 9. **Moving forward: A Possible Strategy to Foster the Development of the ESCO Industry in Europe**, the authors expose “6 areas of activity [...] where concerted action is expected to foster the further development of ESCOs in Europe”. Out of the 6 areas, in our view, 2 concern directly M&V:

1. Area 1: “**Increase Dissemination of ESCO Services and Projects**” aims at increasing the confidence in ESCOs via

organisation of training courses for energy managers and financial institutions, making them aware of ESCO activities, [...], and measurement and verification methods and protocols for measuring energy savings”.

2. Area 4: “**Standardise Savings Measurement and Verification**” deals with the necessity of having “a standardized method for measuring and verifying savings throughout Europe. This will help to ameliorate questionable results of unverified efficiency programs that place a cloud over the entire industry, it would be extremely beneficial to standardise savings measurement and verification procedures to help end-users and financial community better understand EPC and gain confidence in their return on investment.”

FRENCH RENASCENT INTEREST FOR M&V

In line with the European Status Report, French actors are aware of the necessity to strengthen M&V to further develop energy services market. While yesterday M&V was not necessarily stressed upon by service suppliers, today both the European Directive on Energy Efficiency and Energy Services and the French Law on Energy Orientation (“LOE”) introducing the White Certificates process put M&V topics in the heart of their concern. Furthermore there is a strong and growing need and sensitivity of customers regarding transparent and concrete savings which the actors wish to take into account. Thus, the S2E Club launched a study on M&V methods and tools for the assessment of energy efficiency improvement or of energy savings obtained within the framework of an Energy Performance Contract.

Objectives of the study launched by the S2E Club

The study was led from late 2006 (first part) to the beginning of 2007 (second part). The study realises a two-fold benchmark:

- a first part based on an expert review of American and European standards, tools and methods, with a description of the market they address,
- a second part using interviews with experts employed by members of the Club.

After this state-of-the-art review, the technical-economical conditions for use of these tools and methods in France in each sector (households, commercial buildings, industry) is explored with the aim to propose a methodology based on best practices.

According to the content of the results, the study may inspire the Club to write an addendum to the Guidebook related to good practices in M&V.

Overview of M&V methods (first part of the study)

INTRODUCTION

At first a detailed review of European legislation and normative works presenting a relation to M&V topics has been achieved. Two major Directives have been identified: EPBD (Energy Performance of Buildings Directive) and ESD (Energy Services Directive). Related normative works are underway or just

achieved. Concerning EPB standards, formal rules have been settled that can be used in calculation and simulation software tools.

Secondly, an overview of professional guides to implement M&V actions has been undertaken. Apart from normative documents linked to EPBD, thirty-eight methodology guides and reference publications have been identified, coming from very different sources: European Commission, Germany, Austria, United States, Canada, Honk Kong, Australia. They deal with the implementation of EPCs and M&V actions associated, and mainly describe procedures for the EPC as a whole, with no special chapter on M&V elements. Most of them refer more or less explicitly to the International Performance Measurement and Verification Protocol (IPMVP).

In this paper we focus on M&V guidelines, leaving aside the legislative and normative topics.

THE REFERENCE: IPMVP

Rapid overview of the IPMVP content

An accurate determination of energy savings is a key-condition for long-term success of energy management projects. They are determined by comparing measured energy use before and after implementation of an energy savings program. In general:

Energy savings = (Base-year Energy Use) – (Post-Retrofit Energy Use) ± « Adjustments »

The “Adjustments” term in this equation brings energy use in the two time periods to the same set of conditions. Conditions commonly affecting energy use are weather (temperature, humidity), occupancy, plant output, and equipment operations required by these conditions. The difficulty of M&V lies in the determination of realistic rules for the Adjustments term: if for heating distribution a relation between energy consumption and degree-days is easily settled, how to model a whole production plant consumption?

IPMVP proposes four options for the M&V Plan according to the system boundaries of the contract: isolation of a “simple” system vs whole plant (A), partial measurement (including stipulations) (B) vs exhaustive measurement, measurement (C) vs computer simulations using a software calibrated on a data collection (D).

To be consistent with IPMVP, the contract must settle items such as:

- Identification of the person responsible for M&V activities
- A description of the Energy Conservation Measure and its intended results
- The IPMVP Option used by the M&V Plan
- Identification of any planned changes to conditions of the base-year
- Documentation of the facility’s base-year conditions and resultant base-year energy data
- Establishment of the set of conditions to which all energy measurements will be adjusted
- Specification of the metering/measuring (equipment, location, duration of metering periods...) specific to the M&V

Plan dedicated to the customer site, how the base-year energy use and base-year conditions shall be established

- Information specific to the IPMVP Option; e.g. for Option D report of the name and version number of the simulation software to be used, copy of the input files, output files, reference of the weather files, noting which parameters are measured and which assumed
- Specification of the details of how calculations should be made by stating the variables to be measured and any associated assumptions
- Reports to the customers, their contents and formats, periodicity

IPMVP recommends that average annual savings determination costs do not exceed 10 % of the average annual savings being assessed.

These items are right in the centre of the process led by the Club. An important point to us is the balance between the M&V Plan cost and the savings at stake.

The practical guide: FEMP M&V Guidelines

The “Guidelines for Federal Energy Management Projects” (FEMP M&V Guidelines) are dedicated to the federal local agencies in the US to help them implement the IPMVP principles. The effort is aimed at this target group for the reason that “as the largest energy consumer in the United States, the federal government has both a tremendous opportunity and a clear responsibility to lead by example with smart energy management. By promoting energy efficiency and the use of renewable energy resources at federal sites, the Federal Energy Management Program helps agencies save energy, save taxpayer dollars, and demonstrate leadership with responsible, cleaner energy choices.”

The guidebook discusses concrete examples for the four M&V Options defined by the IPMVP. According to the IPMVP Option chosen by the Parties, the document presents quite precise guidelines (up to the equations) mainly in the fields of lighting, motors, chillers, new construction. Thus, in our opinion, it constitutes the most complete and most useful guide.

Conclusion: IPMVP, a solid foundation in consistency with the Club reflection

The review of reference documents and practices in M&V through bibliography leads to the conclusion that IPMVP is considered as a satisfying methodology and the definition of good practices might be based on these concepts, for several reasons:

- definition of different M&V Plan options, with a freedom to choose one according to the problem to tackle,
- inclusion of a reflection on the M&V Plan at the contract preparation phase, and formal definition of the M&V Plan within the contract; to detail the measurement and verification plan in the same way as the energy saving program must be a matter of thorough discussions with the customer,
- attention to the balance between the M&V Plan cost and savings at stake.

Review of the French practices in M&V (second part of the study)

OVERVIEW OF CLASSICAL CONTRACTS

At the time of sending this paper, the second part of the study is not complete yet; a delay in the study makes the achievement of 2nd phase result drift to after the publication of ECEEE 07 proceedings... but it should be completed before ECEEE 07 takes place, so **the audience will have access to fresh news!**

We can though describe French practices concerning EPCs in Public heating contracts as a basis for the rest of the market. Actually, the structure of EPCs in the private field derive widely from public contracting rules. First of all we give details on the variety of contracts offered by the CCTG n° 2008 and n° 2008bis (source: L. GAYRAL – see Figure 1). Hereafter we sum up again their names, content and cost composition:

- P1 energy purchase – energy cost
- P2 daily operation – manpower and current maintenance costs
- P3 full maintenance – heavy maintenance and global warranty costs
- P4 new equipment financing – investment amortization

All of the different types of contracts can comprise incentives for energy efficiency improvement (see Figure 3).

P2-type contracts (also called 'PF' for Prestations-Forfait)

According to the CCTGs, the item P2 is the only mandatory term of a heating contract. The administration is responsible for the fuel purchase, the contractor's fee is fixed. It represents the minimal form of an operation contract, upkeep of the facilities is determined in advance by a certain amount of manpower, with no guarantee in the result. For the contractor, the link between the fee he receives and the expenses he incurs (manpower, equipment amortization, overhead charges...) and benefit he earns must be available if requested. The impact on energy efficiency of this contract depends on the on-site presence level of the contractor, on the follow-up and upkeep he performs.

P2 (+P1)-type contracts

This category, P2 accompanied by P1 (fuel purchase), presents a variety of sub-divisions. The contracts differ according to the mode of determination of the fee. Generally they all present a guarantee of a temperature inside the building. The energy efficiency improvement depends on the degree-day indexation formula settled by the contract. Customer's payments are usually based on the costs incurred, or proportional to the delivered energy.

- *Fuel and Operation Contract (also called 'CP' for Combustibles-Prestations):* operation (P2) with fuel purchasing (P1) in volume. The customer pays the actual fuel consumption.
- *Fixed-Price Contract (also called 'MF' for Marché à Forfait):* operation (P2) with fuel purchasing (P1). The amount for the item P1 is pre-established independently of the weather. This is determined for a given contractual heating period (180 days for instance) and a theoretic base consumption.

- *Temperature-based Contract (also called 'MT' for Marché à Température):* operation (P2) with fuel purchasing (P1). The amount for the item P1 is pre-established and weather-adjusted. The reference fuel consumption is based on a contractual amount of degree-days, and adjusted to the effective number of degree-days observed. The contractor guarantees a temperature inside the buildings and establishes invoices according to the degree-days recorded.
- *Meter-based Contract (also called 'MC' for Marché au Comptage de Chaleur):* operation (P2) and fuel purchase (P1). The amount for the item P1 is based on the delivered heat quantity, measured by an energy-meter. A MWh price is settled at the beginning of the contract, it can be reviewed according to the fuel price variations in the proportion of their supposed use.

P3-type contracts

The item P3 requires a thorough preliminary study of the actual condition of the facility. The border between current maintenance and heavy maintenance must be defined. The energy efficiency performance of these contracts depends in particular on the strategy of maintenance.

The core-question of investment funding

The item P4 is not allowed in public authorities in reference to the Public Procurement Code. Article 10 states that public contracts can be either split into separated items ("allocated contract") or considered as a global contract. The administrator in charge of the purchase makes an argued choice according to the economical, financial and technical advantages they bring. For contracts comprising both construction and O&M of the facility, construction will compulsorily be the subject of a separate item in the case of an allocated contract. In the event of a global contract, construction costs on the one hand and O&M costs on the other hand are clearly and separately displayed. The payment for O&M cannot in anyway contribute to the payment for the construction. This article forbids the public authority to stagger its investment funding through the contract duration. In the case of a global contract, the investment must be paid for as soon as the asset is checked and signed for.

The translation of this clause into the field of energy efficiency contracting is quite immediate: investment costs for the achievement of energy performances (i.e. thermal insulation, efficient equipment purchase...) are clearly separated from building operation costs (i.e. HVAC management, lighting management...).

This restriction is an impediment to EPCs insofar as long-term energy conservation measures usually comprise a part of equipment/building refurbishment. Nevertheless, as funding can occur through leasing or Third-Party Financing by means of a separate item, EPC is therefore legally possible on condition that the funding arrangement is covered by a separate item, which further complicates a type of approach that is already complex.

The restriction is only valid for public sector, and generates no impact on the private one.

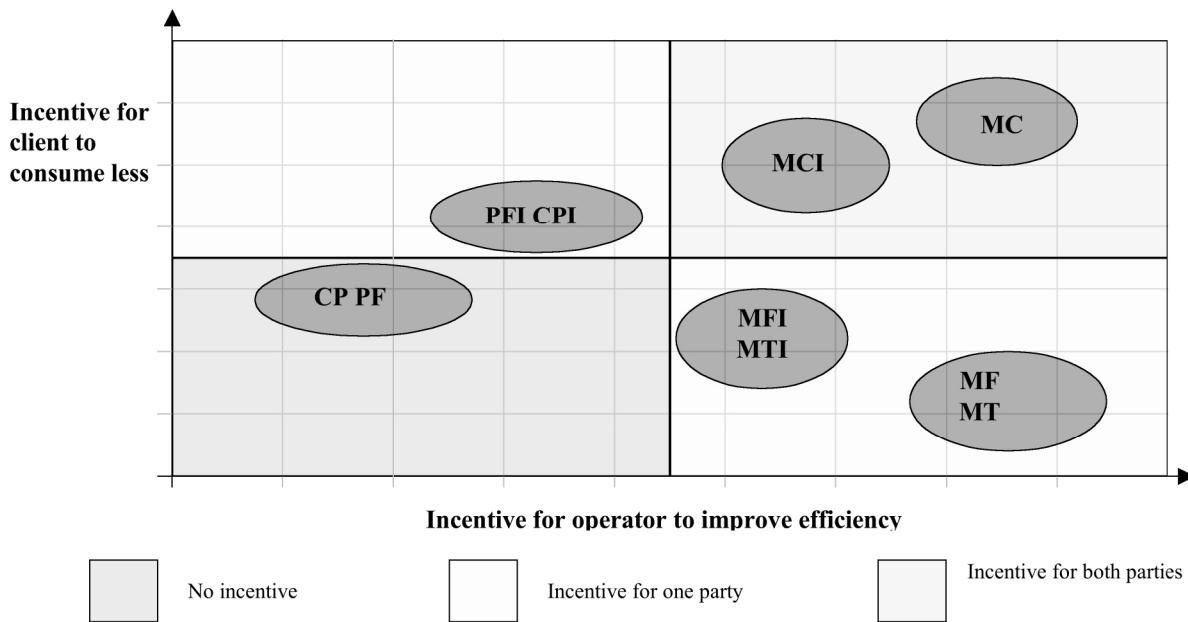


Figure 3: Matrix presenting the inclination towards energy savings according to the type of contract; legend: CP Combustible-Pr-estations (i.e. P1+P2); PF Prestations-Forfait (P2 fixed-price); MF Marché à Forfait; MT Marché à forfait-Température; MC Marché Comptage de Chaleur; for all: suffix 'I': with energy efficiency Incentives

A new tool liable to favour energy efficiency investments?

New prospects in for EPCs originate in the introduction of Public-Private Partnership (PPP) contracting ruled by the Order n°2004-559 issued on June 17th, 2004. According to ADEME [2] this innovation is changing the investment funding context. These special contractual arrangements should in effect allow performance targets to be introduced into calls for tender, particularly with regard to defining the level of energy consumption to be attained. PPP contracts are global administrative contracts by which a local authority or a public establishment associates a Third Party with the funding, design, production, conversion, operation or maintenance of public equipment, or with the funding and management of services. This type of contract is neither a public contract nor the delegation of a public service, but represents a new category of public contract that has a specific award procedure, even though there are numerous similarities with the delegation of a public service.

The Order emphasises the requirement of a prior appraisal which the public body must undertake before the procedure is initiated. In this appraisal, the local authority has to justify the complexity of a project or its urgent nature, precisely describing the economic, financial, legal and administrative reasons which led the authority, after a comparative analysis covering the overall cost, performance and risk sharing of the various options, to adopt the project under consideration and to decide to initiate the procedure for concluding a partnership contract.

A closer look to the market tend to show that the prior appraisal and the technical and economic analyses required in order to use this procedure seem to damp the enthusiasm of local authorities who wish to take up this new tool to fund their investments in energy efficiency. The definition of a functional programme to open the dialogue with the future contractor requires total motivation on the part of the public authority that nevertheless wishes to have recourse to this instrument. In the final analysis, as the legislators have said several times, the

partnership contract should remain an exceptional solution, meant mainly for new building projects.

“ENERGY EFFICIENCY CONTENT” OF FRENCH TYPICAL SERVICE CONTRACTS

Introduction of energy efficiency incentives

For all these contracts, a profit (and loss) sharing can be applied in case of a (dis)-satisfying energy performance. They introduce a share of the profits or losses between the contractor and the local authority. These savings or losses are usually appraised by comparison with a reference energy consumption weather-adjusted. A specific clause sets a reference level of energy consumption, for a given winter cold, denominated NB (stands for “Niveau de Base”). At the end of the heating season, NB is adjusted according to the degree-days, giving NB', which is compared to the actual consumption NC (for “Niveau réellement Consommé”). Both excess or saving of energy, calculated as NB'-NC, are shared between the two Parties. For instance, in a 2/3 – 1/3 share contract the contractor takes charge of 2/3 of the energy excesses whereas the public authority benefits from 2/3 of the savings.

The matrix hereafter positions the different types of contracts according to their liability to make the contractor and the customer energy-efficiency aware (source: ADEME [1] for Eurocontract).

Usual M&V recommendations

The system consisting in defining a baseline reference consumption weather-corrected may be quite satisfying for “simple” building operation. Though it becomes thorny when other parameters influence the energy consumption and must be taken into account: occupancy for swimming-pools or gymnasiums for instance. The problem becomes even more complex when addressing industrial buildings!

Conclusion

French suppliers in energy efficiency services have a full conscience of the need to develop the use of good practices in M&V in order to secure EPCs, inspire confidence to prospective customers and consolidate satisfaction of present customers. The Club S2E, as a gathering of the main actors, promotes a clear definition of energy efficiency services that implies measurable or verified or else estimated savings. As a dedicated place to share methods and tools, and communicate on good practices, the Club S2E intends to incite all the players to integer common and acknowledged good practices, fully fitting the customers needs.

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Glossary

Club S2E:	Club des Services d'Efficacité Energétique
EPC:	Energy Performance Contract
M&V:	Measurement and Verification
ESCO:	Energy Services COmpany
EPBD:	Energy Performance of Buildings Directive
ESD:	Energy Services Directive
IPMVP:	International Performance Measurement and Verification Protocol
EVO:	Efficiency Valuation Organization
FEMP:	Federal Energy Management Program
HVAC:	Heating, Ventilating, Air Conditioning
CCTG:	Cahier des Clauses Techniques Générales

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