The action of EDF in end-use energy efficiency

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Abstract
In order to achieve the sustainability targets of climate change, security of supply, and economic efficiency, present energy efficiency policies create the conditions for the transformation of markets and end users behaviours towards more energy efficiency. EDF, as an energy supplier, has to face at the same time the opening of the energy market and the challenge of sustainability. As energy efficiency for electric utilities in monopoly was mainly based on Demand Side Management (DSM) through electricity tariffs and energy saving of electricity end uses, it is now integrated in the core business and closely linked to the requirement of reducing CO2 emissions. The solutions proposed by EDF include the supply of low carbon energy through nuclear and renewable electricity, and commercial offers saving energy by the improvement of thermal insulation in buildings, the increase of end-uses energy efficiency, and the promotion of distributed heat generation systems using renewable energy (heat pumps, solar water heaters and wood stoves). Suitable conditions of energy efficiency instruments must be developed to accelerate the market transformation towards energy efficiency. The energy savings must be delivered, not only at a high rate, but also with a good level of quality, which requires the involvement of the whole chain of retrofitting building sector. Transaction costs associated to energy savings evaluation and registration must be minimized in order to focus the effort on delivering the savings.

Introduction
Climate change and depletion of fossil energy sources urge society to change the way energy is produced, transported and consumed. Energy efficiency is the first resource to be used in order to allow a sustainable energy development, in association with low CO_2 emitting energy generation technologies, including an increasing share of renewable energies. Markets and end user behaviours are progressively moving to address this sustainability requirement, under an active incitation of policy makers. EDF, which was before the opening of the energy market, a national electric utility in monopoly, has now become an energy supplier in the market, allowed to develop new businesses. The EDF energy efficiency activity was before mainly based on DSM, through electricity tariff modulation and energy savings programs limited to electricity end-uses. The change of energy policy context induces a strong evolution in EDF strategy. End uses energy efficiency and low CO_2 energy solutions are now integrated in the core business.

The new context of end-use energy efficiency policy
In France, the main recent regulations implementing the Directives on Energy Performance of Buildings (EPBD) and Energy Efficiency on end-uses and energy Services (ESD) are the followings :

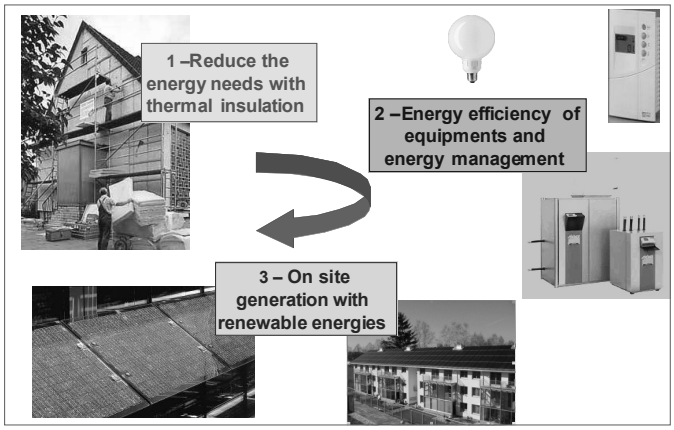

Figure 1: global approach for reducing the final energy demand

- system of Energy Saving Certificates also called white certificates(WhC). Energy suppliers are committed to collect an amount of certificates by delivering energy savings or buying certificates obtained by other parties. During the first period of obligation, started on July 2006 and ending on June 2009, EDF will have to collect 30 TWhcumac1 of energy savings, which is 55 % on the national objective.
- reinforcement of mandatory requirements for the energy performance of new buildings and introduction of energy performance requirements for existing buildings.
- introduction of certificates for energy performance of buildings

On the same time, CO_2 Emission Trading System in Europe and more generally, the necessity to reduce strongly the CO_2 emissions drive the energy and end-use markets towards low carbon solutions.

The EDF strategy: low carbon energy and energy savings

COMMERCIAL TARGETS: CUSTOMER LOYALTY THROUGH COST EFFECTIVE AND LOW CARBON ENERGY SOLUTIONS

As an integrated energy company in the market, EDF must address at the same time cost effective energy solutions to the customers that match their needs, and sustainability targets in order to comply with the policy issues. On this purpose, in addition to the energy supply, the commercial offers propose a global approach, starting from information and advice, then including solutions of thermal insulation, energy efficiency of equipments, energy management and on site carbon free energy generation.

A LOW CARBON ELECTRICITY

On the power generation side, EDF production in France was 481 TWh in 2005, 95 % of it free of CO_2 emissions, with 89 % nuclear, 6 % hydropower, and 4 % coal, oil and gas. The EDF purchase on the market was 36 TWh. The sales were 389 TWh for final customers and 113 TWh on the market and long term contracts. The average CO_2 content of the electricity generated by EDF in France, obtained by Life Cycle Assessment method, was 51 g CO_2/kWh, and 72 g CO_2/kWh for the electricity sold by EDF, including purchase and transport[2].

DELIVERING ENERGY AND CARBON SAVINGS

To comply with the EDF obligation of 30 TWh_{cumac} to be saved in 3 years according to the French white certificate mechanism, it has been decided in EDF to deliver energy savings using the commercial network as the first source of white certificates. Commercial offers have been adapted or developed in the residential, commercial and industry sectors. Partnerships have been contracted with thousands of installers of the building sector, and with energy system and equipment manufacturers. This required a deep involvement of the whole commercial chain, from marketing development through local commercial action. Training programmes are being set in partnership with buildings sector professional organisations, in order to increase installers capacity to master energy efficiency technologies and deliver high quality and reliable solutions to customers. In addition, R&D is developing new technologies for energy efficiency, and knowledge for delivering energy savings at the lowest cost, by focusing on the most cost effective and end-uses and customers.

Commercial process in the frame of white certificates in France

COMMERCIAL SOLUTIONS FOR REDUCING THE ENERGY NEEDS OF BUILDINGS AND IMPROVING EFFICIENCY OF ENERGY SYSTEMS

Retrofitting of households has been identified as the first target for energy savings in the residential sector. The offer, called "objectif travaux", includes the following progressive steps :

- information campaigns in the media addressing advices and incentives to the customers to enter in an energy savings approach.
- first energy audit aiming at identifying energy savings sources and propose solutions to improve energy efficiency
- assistance in the implementation of proposed solutions through mobilization of partners (business professionals) and financing proposals
- quality improvement and control process, including training of local professional partners, and on site controls by external organisation.

1. kWh_{cumac} is the unit selected to count energy savings in the French white certificate system. "cumac" means that the savings are cumulated over the lifetime of the measure and discounted at a 4 % rate.

2. EDF internal report, available on demand. Official 2005 EDF annual report indicates 48 g CO2/kWh instead of 51 for electricity generated by EDF because it has been published in direct emissions, while the data given in this paper have used the LCA methodology.

After 6 months of white certificate operation, the energy savings in the residential have been obtained by EDF through 60000 retrofitting of households, mainly on the following measures :

- loft thermal insulation
- efficient double glazing
- wall insulation
- heat pumps
- gas condensing boilers
- energy management systems
- solar water heaters
- wood stoves

To address home lighting and electric appliances on mass markets, marketing campaigns are being experimented with distribution sector, in order to deliver cost effective measures. EDF has set a on-line shop ("la e-boutique") to sell energy efficient appliances through internet channel.

PARTNERSHIPS WITH LOCAL PUBLIC AUTHORITIES

Partnerships with local public authorities address two different responsibilities in the local energy efficiency action :

- improvement of the local municipality building energy efficiency. Global agreements have been contracted with municipalities followed by contracts on targeted energy efficiency improvements, based on audits, investment programmes on building envelope insulation, energetic equipments and lightings, and staff education.
- energy efficiency policy implementation at the scale of the region or department. For instance, EDF has been selected by the Picardie Region to propose soft loans for loft thermal insulation in the region households and to implement insulation through its installers networks.

ENERGY EFFICIENCY IN INDUSTRY

Industry is the sector where energy efficiency has been continuously improved during the last decades, compared with the other sectors. Nevertheless, much can still be done, as the cost-effectiveness of investment is the first factor of decision making (which is different for instance in the residential sector).

EDF carries out targeted energy-efficiency actions on industrial factories. These measures concern industrial utilities and manufacturing process :

- motors : high efficiency and variable speed drive
- lighting
- efficient boilers for steam and heat generation
- energy efficiency of steam installation
- energy efficiency for compressed air
- heat recover
- gas and electric furnaces

Feasibility studies occurs on a voluntary basis or in order to satisfy specific needs of the client and must allow to detect, localise and roughly evaluate possible energy and money savings. It is generally followed by an audit during which several technical solutions are proposed and costs/benefits are detailed. For larger industrial clients, energy audits are the basis of the "contract of progress" provided by EDF in the frame of which a certain volume of energy savings are ensured by the energy supply contract.

For example, a manufacturer from the automotive industry asked EDF to find solutions in order to optimize a heat-exchanger production chain. After an audit based on infrared measurements and computer simulations, EDF proposed to replace the existing electrical oven (pure joule effect) by an induction oven for the brazing of heat-exchangers. The direct benefits for the client are important: the maximal input power decreases of 65 % (180 kW to 63 kW) and energy consumptions for 100 pieces are reduced of 61 % (160 kWh to 63 kWh). As co-benefits, the new equipment is now much more compact (5 m long against 35 m) and the product quality has been increased.

Transaction costs for delivering and registering energy savings

Beside this commercial process, a system for collecting and verifying energy savings has been set-up. This system is required to submit to the public authorities the demand of white certificates associated to the energy savings implemented. During this first white certificate period 2006-2009, EDF will have to handle around 500.000 energy savings operations on the mass market. Each operation includes many parameters to be registered. For the residential sector, the data processing circuit is the following :

- once energy savings actions have been carried out in customers'homes, partners fill in a data sheet (including data such as name, address, type of equipment installed…)
- EDF technical experts check data, which are then registered,
- files for white certificates request are prepared by addition of individual operations and controlled. Operation that don't comply with the requirements are eliminated and sent back for improvement of data quality
- the program file is sent to the public authority for certification
- quality controls are also carried out at customer homes by a certified organisation

R&D on energy efficiency in buildings, industry and transports

ADVANCED THERMAL INSULATING MATERIALS

Thermal insulation retrofitting of buildings faces in France barriers that limit energy efficiency increase . The products are more adapted to new buildings than retrofitting.

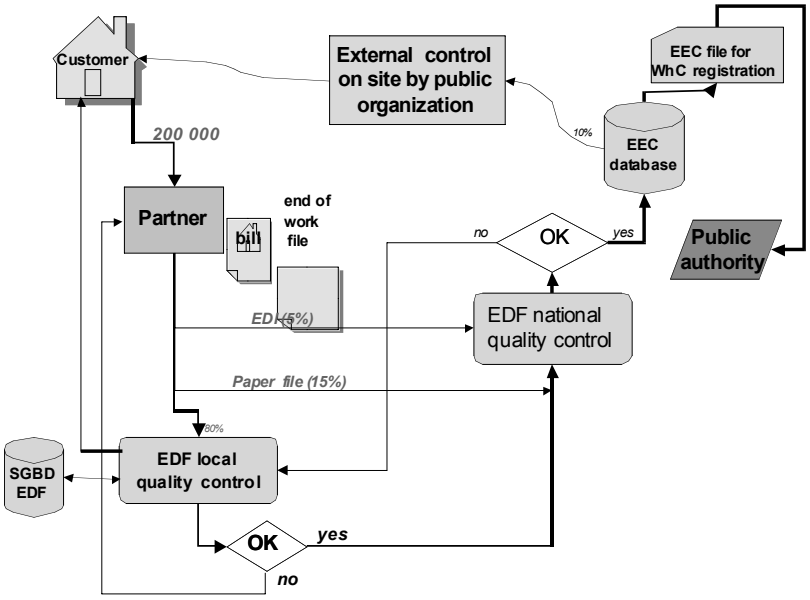

Figure 2 : EDF process for collecting, counting and registering white certificates and for quality control

EDF R&D investigates with industrial partners new thermal insulation products :

- new materials for external thermal insulation, allowing a market development in France
- thin insulating materials

HEAT PUMPS FOR NEW AND EXISTING BUILDINGS

The mid-term (2015) objectives of EDF R&D in heat pumps technologies are to increase the economic and energy efficiency of the solutions :

- seasonal coefficient of performance of: 3,0 for air/air systems, 3,5 for air/water systems, and 4,5 for geothermal systems
- cost reduction, addressing both the thermodynamic systems and the techniques of drilling for geothermal heat pumps

SOLAR EQUIPMENT FOR NEW AND EXISTING BUILDINGS

EDF R&D innovates in solutions such as:

- solar domestic hot water new generation
- PV new generation and PV integration in buildings
- hybrid PV

ENERGY EFFICIENCY IN INDUSTRY

EDF R&D in industry energy efficiency addresses both energy utilities and manufacturing process :

- energy management monitoring systems on the software side
- development of cheap sensors for reducing the cost of energy performance measurement
- new technologies of cold generation systems
- heat pumps and mechanical vapour compression for concentration and drying
- new applications of induction heating
- diagnostic methods for heat recovery :

PLUG-IN HYBRID VEHICLE

In the transport sector, the CO_2 reduction of individual cars can be reduced by the improvement of motor energy efficiency, by the use of biofuel, but also by the use of electricity when this electricity has a low CO_2 content. Beyond Hybrid vehicle like Prius, that reduce the oil consumption, Plug-in Hybrid Vehicles constitute an emerging option that allows to combine oil and electricity as fuels for the vehicle. In addition to EDF R&D on advanced batteries, EDF has close discussions with automotive manufacturers on how to promote this technology.

Conclusion

The requirements of sustainability drive the society towards more energy efficiency and less CO_2 emissions. EDF has integrated these evolutions and is deeply involved in energy efficiency and CO_2 emission reduction. EDF strategy is to propose to the customers energy solutions that satisfy these requirements. This is implemented through commercial offers that include both a low carbon energy supply and services to save energy and money. The white certificate system in France challenges EDF in delivering energy savings in the most effective way. This new energy efficiency policy tool is experimented during this first period of 2006-2009. It is an opportunity for all the stakeholders to learn on the best way to save energy and carbon emissions at the lowest cost for society, while maintaining confidence of all the parties involved.