

# **R&D at EDF**

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You will note similarities and differences between what Roger Lanoue and Mr. Tachibana have talked about and what I will be presenting on EDF.

I am in a bit of a situation: though my IERE colleagues would like to know more about what accounts for EDF's success with R&D, most of you already know what I will be talking about. I will therefore be brief.

Similarly to my colleagues' presentations, I will be mentioning a few of our successes. I will be talking about the current status of R&D at EDF and on the company's situation. Lastly, I will briefly review our concerns about what the future holds.

## **I. Examples of successes**

Increasingly, R&D is helping line personnel choose and specify new materials so that the right types of suppliers are chosen. I stress the importance of this role since this is not something that naturally comes to mind. Last year we succeeded, by pooling our efforts with the purchasing department and distribution system personnel, to specify new cables. A well-managed call for tenders further allowed us to reduce the cost of the cables by 10%. Given that we purchase thousands of kilometers of cable each year, this is no negligible amount.

I would like to mention a second, more scientific example of this role which some would refer to as "high-end consulting" but which is nonetheless necessary. It pertains to nuclear energy. One weekend, slightly contaminated water had leaked from a power plant. We needed to determine, through quick calculations, that the water table presented no risk of contamination for users and riverside dwellers. Thanks to a software program developed by the R&D division, we were able to solve the problem in 48 hours.

My third example is completely different. As you know, we have thermal plants in many countries, some as far away as Mexico. We implemented a system whereby power plant control and operational data can be gathered remotely. This system is designed to remotely mobilize the top experts to help an operator experiencing problems, whether in Mexico, Port Said, or elsewhere.

As a final example, I would like to mention the development of an exceptional calculation program that combines fluid and solid mechanics. It has enabled us to understand the origin of the large cracks that appeared on the auxiliary pipes of the Civaux power plant and to find a way to modify its geometry, when it was being repaired, in order to prevent such an incident from recurring.

So there are four relatively different examples which, while being operational, assume some upfront long-term development work with scholars and research centres from other electric utilities or French or foreign universities.

## **II. The role of R&D within the organization and R&D activities**

Just like our colleagues, our work involves careful balancing – one that is at times difficult to maintain – between the short, medium and long term, and between monitoring and operations. This is a concern shared by management, which must be relayed to the teams so that they resist the temptation of focusing exclusively on helping the operator, even if this is undoubtedly useful and profitable to EDF.

Note that EDF has 100,000 MW in installed capacity and 30 million customers in France, but it is also an international organization with over 40% of its installed capacity and about 20 million customers abroad. For several years, in fact, we have been providing the Queen of England with electricity to boil water for her tea... and we also supply power to many others throughout the world.

### **1. EDF's structure**

For our IERE colleagues who are not familiar with it, I would like to briefly review the way our company is set up. We are structured in branches that are primarily operational in nature. Headquarters are in Paris, in Wagram, and R&D is primarily concentrated in France. However, we are also expanding outside of France:

- In Karlsruhe, Germany, where we share a laboratory with the University and EnBW;
- In some subsidiaries whose activities are both internal and external, and with which we are working on developing shared programs.

## **2. Key players in research**

I will limit myself to a national scope, which includes the locations of Clamart, Chatou and Renardières. In France, the R&D branch has a staff of 2,400, including:

- 2,000 researchers, engineers and technicians;
- Researchers teaching abroad;
- Doctoral students, whose numbers should be increased.

## **3. Our expertise**

Our expertise matches that described by our colleagues. It touches upon the company's various areas of activity, both industrial and service-related.

Naturally, generation – in particular nuclear energy – is our primary focus. But we are also active in other types of generation, some of which, such as renewable energy, are emerging.

We are also working on commercial development. EDF is known for its personnel's work in this area and the support it provides should be reinforced.

We are still working on developing our transmission systems so that the structural changes imposed by deregulation in France can be realized.

We are obviously concerned about the environment, striving to limit the environmental impact of our power plants and complying with regulations, while adopting even more stringent standards.

Finally, we are looking into using information technologies to optimize EDF's operations.

#### **4. Budget**

Nuclear research takes up almost 40% of our R&D budget. Note that part of the research in this area is done in conjunction with the Commissariat à l’Energie Atomique. Electrical power research accounts for one fourth of the budget, and commercial development slightly more than one fourth.

#### **5. R&D internal structure**

R&D is structured around a laboratory division and program managers who are in charge of optimizing the portfolio of activities in each core area: business customers, generation, and transmission systems/environment. The managers discuss with the line staff which projects should be initiated, pursued or shelved. They also ensure the integration, into the portfolio of activities, of medium- and long-term projects which extend beyond operational projects.

The breakdown of activities over the short, medium and long term are as follows:

- 15% for long-term projects involving the acquisition and development of expertise and new tools;
- 17% for front-end studies which represent projects of three to five years in duration, depending on whether the field is power systems, nuclear energy or commercialization and information technologies;
- 54% for projects involving completed products or services, leading directly to operational applications (improved facilities or new services offered by the commercial teams);
- 14% of services provided to line staff, for whom we are “putting out fires” to some extent.

#### **6. Funding and regulations**

Regulations have changed and will continue to do so systematically and intelligently since people are involved behind the standards. It is therefore better to properly apply regulatory systems than forever changing them.

Currently, 75% of our activities are covered by the branch budgets and are therefore funded directly by the branches. It is through discussions with line staff that the subsequent year’s program is defined and an agreement signed with the branches. This

system was set up last year. The agreement is signed at the highest level of the branch, and I am in charge of signing the agreement for R&D.

The remaining 25% is spread out between activities conducted at the request of the company's main directorates (e.g. strategy directorate, environment directorate), complementary activities which we are responsible for, such as standardization and documentation, and activities that we decided to carry out for future needs (consisting of innovation activities which we call "level 1").

For the current year, we worked on a performance project that has almost been completed aimed at estimating the net discounted value of 83 projects which were completed in 2003. This project was based on core areas. The results are relatively close to those presented by Roger Lanoué in terms of the ratio between the net discounted value and the total discounted cost. Once the final figures are available, the document will be published and widely disseminated since it is important for us to continue along the lines of this project.

In addition to gains valued at millions of euros, for each project we took the non-quantifiable gains into account. I will only mention the example of nuclear energy which, thanks to R&D, has allowed EDF to establish a relationship based on trust with the Autorité de Sûreté from a technical perspective. When our experts state their opinion on the condition of in-service materials, the Autorité de Sûreté takes their views into account.

### **III. Future prospects**

R&D prides itself, not without reason, on creating the future. The future is uncertain; we are hoping to help build it.

This is the aim of some of our current projects, whether they target our customers, deal with environmental issues and sustainable development, or with performance through nuclear energy.

We have and intend to keep test facilities, and we develop simulation tools; either we create them ourselves, acquire them, or develop them in partnership with others. Naturally, we are concerned about generating cleaner energy. We will therefore step up our efforts on the environmental front since this is a universal problem.

Lastly, we are trying to be part of scientific breakthroughs, not only for our researchers' benefit, but also because we are convinced that the most advanced scientific methods will boost our revenues and improve services to our customers, as well as our relationship with the community and governments.

The most advanced scientific methods become operational over the years and of standard use. In this respect, R&D attempts to anticipate the investments needed in advanced fields. This is the direction of a project I initiated a few months ago entitled "Défi" ("challenge") to define what needs to be done over the medium and long term, i.e. within the next 5 to 10 years and even beyond.