# Impact of electrical industry deregulation on R&D management

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I will be speaking about R&D management in the competitive market which has arisen from the deregulation of electricity in Japan. In 1995, the wholesale industry was deregulated, followed by the retail sector in 2000 for consumers of over 20 kV or 2000 kW. In 2004, this level will decrease to 500 kW, while an additional decrease is already under way.

## I. The impact of deregulation on management

Costs must be reduced throughout the electrical industry, in R&D as in operations and production.

R&D expenditure has traditionally been considered as a mandatory expense in the operation of a power system. R&D costs could be covered by tariffs decreed by government. In the new open-market system, these costs are easily absorbed through investment. No R&D projects must therefore be undertaken without the guarantee of an adequate return on investment.

Moreover, the relationship with eligible consumers must be reconsidered. In the 20th century, the level of electricity demand from Japanese manufacturers was high and the electric utilities' sales depended on these customers. Recently, however, the growth in electricity demand from these customers has decreased, then deregulation was introduced and many consumers turned to natural gas to meet their energy needs. We can therefore no longer count on loyalty from customers, with whom we must redefine a relationship.

As for intellectual property, its importance is undeniable. If, in the past, it could be neglected without any repercussions, it has now become a strategic element for operators in a competitive environment.

Lastly, and most importantly, the *raison d'être* of R&D departments appears to be in question. As Mr. Lauby mentioned, the total R&D expenditure in Japan has not decreased. However, for some time the government has been spending more on nanotechnology, biotechnology, information technology and the environment to the detriment of energy. A decrease in public spending in our industry is therefore underway.

## II. Dealing with challenges

My first action was to restructure research and development at TEPCO. Managers have had to set target objectives, intellectual property management was bolstered and an evaluation method was introduced. For the first time, guidelines have been set for the allocation of budgets.

### 1. Restructuring the R&D department

TEPCO had four research centres which we have grouped into one. The research groups have been reduced from 30 to 21. We then grouped them into three categories.

*a. Project groups*

Each group has a specific objective and its manager must realize the group's mission in two to three years, otherwise he/she is transferred within the company.

*b. Sector-based research groups*

Their design is fairly conventional. For instance, the thermal generation technology group is dependent on the thermal generation department and meets the needs of the thermal power plants.

*c. Fundamental-research groups*

These include a human factor group, energy system technology group, equipment group, etc.

### 2. Setting target objectives

Each manager is assigned target objectives. Naturally, the figures are confidential and I cannot provide them. The objectives for 2005 are as follows:

- Cultivate demand by developing new technologies to win back customers from natural-gas companies and other energy providers;
- Set cost-reduction objectives;
- Develop the market since energy demand in Japan is not increasing as quickly as in the past (TEPCO, like other companies, must diversify using the research and development centre);
- Reduce $CO_2$ emissions;
- Improve the recycling rate for household waste.

### 3. Strengthen intellectual property management

I myself have bolstered the intellectual property managerial function, clarified responsibilities and hierarchies, and promoted an incentive system and personnel management.

### 4. R&D evaluation method

I introduced an R&D evaluation method. For the time being the method is only experimental and we are not relying exclusively on this method, but it is one of the criteria that each group manager must meet. The idea is to quantify the contribution made by each research area before evaluating an R&D budget.

The evaluation method uses a graph in the form of a scatter diagram which takes into account the level of maturity of the projects and their respective cost. But some projects cannot be quantified in such a way: in this case, a grading system is used. For instance, environmental research cannot be easily quantified in yens; this is another lesson learned from the evaluation method.

### 5. Guidelines for R&D budget allocation

In the past, operators could obtain funding fairly easily for the research projects that they wished to carry out since their cost was absorbed by electricity rates. R&D investments must now be covered by revenues and market prices. Under these conditions, one can understand the importance of imposing guidelines and subjected research budgets to them. In 2003, TEPCO managed to allocate 64% of its R&D budget to areas covered by the scope of these guidelines.

## III. A few examples of R&D in a competitive market

### 1. Developing applications aimed at retaining customers

To increase our competitiveness in the natural gas industry, we developed a heat recovery boiler that uses $CO_2$ as a coolant for industrial purposes. This is the result of a fruitful collaboration with CRIEPI, which handled a large part of the fundamental research. Another area that is highly competitive is household appliances, for which we have set up a performance evaluation laboratory. Lastly, we developed a battery system called NAS for electricity storage.

### 2. Increasing competitiveness to adapt to an open market

A reduction in thermal power plant maintenance costs is needed. Thanks to the methods we use to evaluate the lifespan of components subjected to high temperatures, we send our test results to the power plants so that they may reduce their costs.

We still have traditional research laboratories that use power system simulators combined with computer programs. We will need this type of technology, especially when decentralized generators must be connected to the power system.

To reduce transmission and distribution maintenance and operating costs, the availability rate of transmission infrastructures is in the process of being increased. We are testing CV cables to determine how much their maximum temperature can be increased without reducing their 30-year lifespan.

On the nuclear front, we have a laboratory where researchers study stress corrosion cracking. Monitoring this type of crack requires that all our nuclear power plants be shut down from time to time. Thanks to our researchers' work, a new power plant has been designed that does not present this drawback.

### 3. Diversifying our activities

We have developed a technology where photographs are transmitted by solar energy, which was originally intended for transmission line maintenance. This system can be used to monitor the environmental impact of high-voltage lines on wildlife. The scope of application is vast and no doubt represents state-of-the-art technology.

## 4. Finding solutions to social and environmental problems

In terms of climate change, we have conducted a study on carbon wells and the storage capacity of carbon dioxide in the Japanese forest ecosystem.

We also did a study on the human factor in the nuclear industry.

Lastly, to deal with a competitive environment, we are trying to increase the authority of our managers. They must meet very high objectives or they are transferred. On the other hand, they are given more responsibilities.

In addition, we have implemented performance evaluation grids for our researchers, even if this initiative is not appreciated.