

# **Research contracts with third parties on the deregulated electricity market**

**Nano BOLT**

**In charge of production systems at KEMA**

Before talking about contracts with third parties, which shall be the final part of my presentation, I would like to discuss R&D trends in the electrical industry in Europe and the Netherlands, as well as the resulting way in which the R&D structure has changed.

## **I. Market deregulation**

The Dutch example is symptomatic of what has occurred over the last three to four years with the deregulation of markets.

In the Netherlands, three out of four power producers are now foreign and are based in Belgium (Electrabel), Germany (E-ON) and Texas.

There is a trend on the markets toward a decrease in size: the large regional companies are giving way to small players. In addition, markets tend to become fully deregulated and, while I cannot predict the consequences on power producers, I know that there will be some. Independent power producers, especially those involved in industrial cogeneration, are already increasing their market share, just like transborder exchanges, which about a year and a half ago accounted for over 20% of electricity consumption in the Netherlands.

The appearance of independent markets is another determining factor in this changing situation. The Amsterdam Power Exchange is thus a market where producers propose quantities in kWh and the respective prices to consumers, who choose their supplier for a 24-hour period. This market represents 20% of electricity consumption in the Netherlands during business days, which has a major impact on electricity generation.

The last crucial element is that of consumption peaks, which present a problem in terms of ensuring that the supply meets such massive demand. These peaks do not always occur at noon on business days and can be impossible to predict. On average, full hours

are billed at 20 Euro cents per kWh and this is how power producers realize substantial profits.

Lastly, there is still talk about excess generating capability in Western Europe, but one needs to take into account the increase in consumption. The Netherlands will not have any excess generating capability next year.

## **II. Impact on R&D**

In terms of R&D, cooperation and risk sharing are especially sought after in two areas: non-competitive R&D and pre-competitive R&D. The first pertains to issues such as environmental regulations, working conditions and health, and waste management (e.g. fly ash from coal plants, clinker). These issues are not perceived by producers as being part of their responsibilities, such that they are seeking to share costs and innovations. Pre-competitive R&D pertains to materials, for instance; the spread of a crack requires research into physical and mathematical laws which have nothing to do with issues of competition. On the other hand, when instruments used to study the expansion of cracks are used by competitors who incorporate their risk profiles and operational methods, then the tool becomes competitive.

The return on investment, previously anticipated over the long term, is now expected over the short term. The return on investment expected by our financial backers is usually calculated over two years starting from the start of the project, such that most of our projects are not more than six months long. This is no longer really R&D but rather a final development phase.

Finally, in all companies the trend is toward limiting spending, which serves as an incentive to applying for grants from national or European public organizations.

## **III. R&D issues in a competitive environment**

Deregulation more than anything has led to a certain number of R&D objectives:

- Extending the lifespan of equipment to prolong the use of physical assets;
- Biomass co-combustion to meet the requirements of the Kyoto Protocol and replace 20-25% of coal-based generation;
- Operational flexibility, which is a major issue.

Furthermore, last December, the European Union adopted a guideline for CO<sub>2</sub> markets. Next year, CO<sub>2</sub> exchanges will begin, though many technical problems need to be resolved.

With respect to electrical power transmission, the advent of intelligent networks presents opportunities for increasing transmission capacity and security.

All of these issues are centered around short-term R&D, which creates a new need for long-term R&D. Last year, we drew up a technological road map for power system technology in the Netherlands. In it we attempt to determine the power system technologies that will be needed around 2005. This document was produced at the request of the state and high-voltage system producers and operators. Its main objective is to determine a research plan for the long term.

To do so, we have drawn up several long-term electrical supply scenarios, with two extreme scenarios: a total free-trade scenario, and an extreme environmental scenario. However, in the four scenarios that we studied, the following common trends emerge:

- Increase in electricity consumption from 60 to 70%;
- Increase in import and export capacity;
- Decrease in power plant capacity from 12,000 to 6,000-8,000 MW;
- Increase in decentralized generation (wind energy, especially off-shore generation);
- Biomass which is proving to be the main source of renewable energy.

A research plan provides an idea of what we would like to see in 2025 by forecasting target figures and by defining who will be in charge of financing. In most cases, funding will come from generating facility operators, with the government being the key player for more fundamental research. Lastly, users will be responsible for research regarding end use consumption.

#### **IV. Electricity R&D trends in Europe**

Last March, EURELECTRIC, the Union of the Electricity Industry, issued a report on R&D trends in Europe. The report includes a little of what I have talked about. The market factors that have been identified are cost reduction, energy efficiency, the security of the electrical supply, and environmental regulations.

In terms of R&D structure, the report notes that in Europe there is a trend toward downsizing the large departments in favour of small applied research units. The report also talks about a trend toward externalizing R&D.

Regarding projects in Europe, the report indicates that most R&D projects originate from bottom to top proposals, from researchers and approved by management.

The report's authors also note a lack of financial and human resources and a shift toward short-term projects. They also believe that there is a tendency to favour competition over cooperation. They state that projects are funded in part through self-financing and by an amount included in electricity rates. Lastly, it would appear that some companies are resorting to subsidies provided by the European Union.

## **V. The transformation of KEMA in 20 years**

Just a short time ago, KEMA was still a public organization. In the 1980s, there were about 70 small electric utilities in the Netherlands that were vertically integrated (generation-transmission-distribution) and owned by local communities. KEMA's director was also chairman of the Producers' Council. At the time, annual growth in consumption was 10%. KEMA only had a branch in Arnhem and an R&D division which included 150 to 200 employees. Revenue came from our only customers, i.e. electric utilities. R&D accounted for over 95% of revenue. At the time, 50% of R&D in the Netherlands revolved around nuclear energy. Then came deregulation, independent power producers, the Amsterdam Power Exchange, and lastly a major privatization movement.

There were changes in our relationship with R&D clients. In 1994, we switched from a contract-based system with mandatory means to a system that required results.

Like TEPCO, we analyzed the return on investment for larger projects, which for us represents 40% of all projects. We used a probability of technical success and a productivity indicator. Naturally, this assumed that we had quantifiable objectives. But for long-term, exploratory research, we used a multi-criteria method. These days, financial backers use a competitive approach and do not wish to share potential profits. This is more difficult to achieve in a competitive environment.

To evaluate our quantifiable projects, we developed a method for calculating the investment/profit ratio. Based on a given budget, the projects are selected according to their productivity index and cost. The multicriteria analysis that we use for exploratory research is more qualitative in nature. It aims at providing management with an idea of the quality of the projects and more streamlined support in selecting projects to be developed.

As for KEMA's transformation process, it shows what can happen in a deregulated environment. KEMA has been operating independently since 1990 and is no longer tied to the Producers' Council. A structure based on business units has been adopted and we have set up a third-generation R&D management approach. KEMA became a multinational in 2003. In terms of its revenue, 60% comes from international sources and 4% from short-term R&D.

To conclude, a deregulated and open market appears to lead to a difference in size in producers, a reduction in costs, a greater impact from peak periods, and the need for flexible and reliable means of generation. In addition, the security of the electrical supply becomes a crucial issue.

In terms of R&D, the trend is toward an increase in externalization in our regard, and a return to the short term. Non-competitive and pre-competitive research becomes crucial, but in particular there is added pressure for more funding. Sources of funding are more diversified, while public funding is reserved for long-term projects and technologies.

In terms of organizational structure, the trend is toward using business units, a strengthening of commercial aspects, globalization, and the implementation of agencies that provide services and consulting.