TECHNICAL ASPECTS, A STARTING POINT FOR DEBATE

What was first viewed by scientists and engineers simply as a common technical problem has now become a major social issue. The choice of a long-term solution for waste from the nuclear industry takes into consideration all aspects of the controversy, now an integral part of R&D projects. Research, development, and innovation must provide a "constructive" way out of this type of controversy. This is the conviction that scientists and sociologists have come to after two years of cooperation.

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The "pit-head" of the future underground laboratory for research into the deep geological disposal of high-level, long-lived radioactive waste at Bure (Meuse/Haute-Marne) in May 2001.

The social aspects of what was a purely technical debate

Back in the early 1960s, the French nuclear industry found solutions for managing the waste it generated (see box A, ***What is radioactive waste?***). Little information was released on this topic, there was no debate on the horizon, and waste management was a routine operation, not a scientific challenge or a social issue. Since then, controversies have gradually taken over, and are seen by operators as hampering decision making. The dynamics of these controversies must be understood because they are now an integral part of R&D projects.

Previous technocratic models considered social-technical controversies as an exchange of arguments between predefined players and generally opposed the "scientific" arguments of one side with the "less rational" positions of the other (distorted perception of risks). This approach leads to a deadlock where neither side will budge from its position.

The modern view of controversies in democratic societies is backed up by thirty years of investigation into many social-technical crises (e.g. genetically-modified organisms, contaminated blood, BSE, ozone and greenhouse effect, asbestos, etc.). According to this view, increased knowledge alone cannot solve controversies, which are dynamic processes characterized by a proliferation of arguments, scenarios, and players or "spokespersons" of varying identities.

The dynamics of a controversy is related to the way in which the players involved can establish unexpected links between different arguments, leading to the emergence of new themes and modifying the content of the controversy in mid-stream(1).

It is its "proliferating" character that often makes social-technical controversy undesirable. And yet, despite the fact that its occurrence cannot always be controlled, it is socially useful in that it reveals and selects the arguments and players concerned. Once this inventory is complete, the various dimensions of the problem can be approached, associating these players, to produce undisputed facts, upon which a decision can ultimately be based. According to this learning process, the decidable solution is no longer deduced from "technical truths", but built on facts that have been reinforced and proven by controversy(2).

"Mapping out" arguments

The area of controversy is open and constantly changing, and may not be "hijacked" by the technical aspects. For this reason, the debate must be initiated at the earliest possible stage to produce a "map of arguments", comprising opinions, knowledge and oppositions of all relevant players, the only basis possible for strong decisions. Tools are avail-

(1) An example of this is how the negative image associated with "waste" led winegrowers to connect the opening of a laboratory and wine exports: the debate reveals economic and commercial arguments that were not visible with a purely technical analysis. Another example is the way in which participation of the general public in public inquiries gave rise to the theme of "reversibility".
(2) See for example Y. Barthe: "*La mise en politique des déchets nucléaires. L'action publique aux prises avec les irréversibilités techniques*". Doctorate thesis, Paris CSI, December 2000.

able for open consultation of the public: control groups, public hearings, consensus conferences[3]. Making use of them at various stages of the controversy simplifies the collective learning process by promoting exchange before decisions are taken, rather than communication after the event.

Seen from this perspective, the 1991 Act itself appears as a collective learning process, where even opponents become players (for example, the implication of the ecological trend in the **storage** technical option). The 1991 Act stipulates that research should be conducted into nuclear waste management methods. But are the methods proposed competiting or complementary, contemporaneous or successive? R&D projects thus become a field upon which the players involved in the controversy can present properly supported points of view, while technical innovation generates solutions to reconcile initially conflicting interests.

In an environment that is variable in essence – as no demand has yet been built these projects must find a compromise between the need for sufficient progress, despite the vagueness of the demand, to impose some consistency on the points of view expressed by the players, and the need for progress to be gradual to ensure that the range of options is not closed too soon, and that the technical field remains wide enough to accommodate the different players.

Specific features of a viable project

A technical project intended as a support for strong collective decisions has a number of specific features. The project precedes decision-making and *a fortiori* any building project. It is a lengthy project for it aims not only to overcome a technical difficulty but also to converge towards a consensus. Its purpose is to build a consolidated demand, transforming the action of heterogeneous players into a virtual collective customer. This demand from the *virtual collective customer* is one of the project's outcomes, and not an initial given upon which it could be built.

It is essential to produce simultaneously the demand and several concrete images of solutions to steer players into a peaceful debate, rather than opposition out of principle.

The project must not, however, rule out possible choices too quickly. The dose of irreversibility in the choices offered must be carefully balanced, neither too much nor too little. It is important for the project to encompass enough options for the players to recognize one another on the technical field, and to steer a path according to changes in the environment. In this respect, opting for a "champion" technical system too soon can lead to a serious error, because it may be impossible to decide in favor of this technical optimum if it is far removed from the social optimum.

The failure of the project then leads to a never-ending loop mechanism: since no consensus is reached on the goal, no decision can be taken. Loss of memory and/or modification of the questioning technique are organized – consciously or unconsciously – to gain time. This explains why some studies under way in this field are taking so long.

Within this context, does a project still exist? The answer is yes, now more than ever. There must be a before, and after the project; irreversibility is a direction indicator used to move closer to the objective, i.e. to make a decision possible[4]. This is a far cry from the scientist's dogma that tends to confuse decision and deduction, thereby seeking to limit responsibilities ("*science demonstrates*") and risks ("*decisions stem from information that is certain*").

From controversy to collective decision

In a controversial context, the requirement may not be linked to a lack of "know-how", but rather to a lack of "power to act". In this case, the goal of the project will be to produce operational knowledge that can be "put into action". This means building a knowledge structure that can act as a genuine lever to reach a consensus. Technical knowledge is the driving force, materialization (experiments, demonstrators, etc.) is the fulcrum.

Reaching a consensus also implies that the project must be highly adaptable to its environment. The perception of and interaction with the players represent an important aspect of the project which must manage its interfaces adopting a voluntarist approach.

When applied to the thorny problem of the controversy about radioactive waste management, or the renewal of the nuclear power-plant fleet, this analysis based on recognition and respect of the various players points to a clear conclusion: a space for interaction with the main protagonists in society must be created at the earliest possible stage by openly addressing a wide range of issues. Controversy is anything but a disruptive force. It is the source and final goal of R&D, which becomes a tool, an ideal site for collective learning and the making of strong decisions.

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(3) One example that may be mentioned is the consensus conference organized in the United Kingdom on radioactive waste management in 1999. Several countries have organized events of this type to involve the public as closely as possible in sensitive technical issues: Denmark, Canada, the United States, the United Kingdom, New Zealand, Australia, Korea, and Japan. The conferences provide the layman with an opportunity to question experts, thus providing a clearer idea of the questions asked by the man in the street. Also worthy of mention are the initiatives of various institutions in Sweden (SKB, SSI, and SKI), as well as in Finland, favoring contact with the local population.

(4) P.J. Benghozi, F. Charue, and C. Midler: "*Innovation -Based Competition and Design-Systems Dynamics*", L'Harmattan, Paris, 2000.