TECHNOLOGY DEVELOPMENT AND DEPLOYMENT: ACCELERATING THE PROCESS

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ABSTRACT

The obvious objective of technology development and demonstration of environmental technologies is deployment. The track record for acceptance and deployment of new or innovative environmental remediation and waste treatment technologies is, however, discouraging. The obvious questions are 1) why is the track record dismal and 2) what can be done about it? Recent studies and evaluations have identified numerous barriers. Three major barriers are adequacy and credibility of performance data, regulator knowledge of the technology, and public acceptance. A strongly related issue, and perhaps unique because of its potential magnitude, is that of liability. Although these issues are not new, they have generally been addressed in a piece meal manner. The other key point is that these issues tend to be addressed after the technology is developed rather than in parallel with the development. As such, it often takes years to get through the process to deployment, if you can get there at all.

Two recent efforts have been initiated to aggressively address these impediments. These are the U.S. Department of Energy's (DOE) Integrated Demonstrations (ID) and the Western Governors' Association (WGA)/Federal Agency technology demonstration initiative. The IDs and the technology demonstration initiative incorporates full scale demonstrations on contaminated sites with assurance that institutional issues are given the same level of attention as the technical development and design issues. In addition, stakeholder involvement is viewed as a critical issue because the stakeholders make independent decisions and take positions that can directly affect decisions to deploy or not deploy a technology. For the purposes of this discussion, the term stakeholders is used broadly to include any individual or organization that needs to take a position or make a decision regarding the application of a given technology. Thus, stakeholders include the regulatory community, venture capitalists, technology manufactures, suppliers and appliers, interested publics, Indian Nations, and site owners.

The DOE Volatile Organic Compounds In Arid Sites Integrated Demonstration (VOC-Arid ID) has been the most aggressive of the IDs in addressing the institutional issue. Although it is still in the planning stages, the WGA/Federal Agency technology demonstration is designed around the same concepts.

DECISION PROCESS

Technology acceptance, or lack thereof, is the product of several independent decision processes engaged in by different stakeholders with different value systems and different issues. For example, the site owner may be concerned with cost and liability issues. A site owner may well decide not to use a promising new technology because uncertainties in long term performance may leave residual liability. On the other hand, representatives of the interested public may see cost, performance, and the potential for operational accidents as key issues that would drive their decision. There are clearly separate and distinct decision processes being used. In fact, the decisions themselves are different. The site owner is trading off the near-term cost savings of using a new technology versus the risk of long-term financial liability if the technology fails to perform as expected. The representatives of the interested public are deciding on what levels of worker safety and environmental protection are reasonably achievable. The resulting decisions that these stakeholders make lead to a position that the technology is or is not acceptable. Recognizing the actual decision processes that are being used is key to designing an effective stakeholder involvement process.

HISTORIC APPROACH

The traditional focus for technology development is science and engineering. The commonly held view of technology developers is that decisions should be made based on the technical data and everything else is packaging. Thus, the institutional issues tend to be ignored or handled as a last thought if they are addressed at all. The most commonly practiced approach is to develop and test the technology to collect the technical data assumed to be needed to persuade financiers and/or regulators that the technology is a winner. If the developer is fortunate enough to succeed in getting financing and regulatory interest, the technology is developed further and becomes a candidate for use. Remediation firms and/or perspective clients generally begin to get information on the technology and if they are willing to take the risks, the technology may enter the formal decision process which provides opportunities for public comment and input into the decision. This process, performed in a serial fashion as it has historically been done, often takes years and is frequently unsuccessful (see Fig. 1). In retrospect this should not be surprising, since the developers assume what the stakeholders will need and want and they are often wrong. This misinterpretation forces scientists to do additional work to get the required information and to come back and try the decision

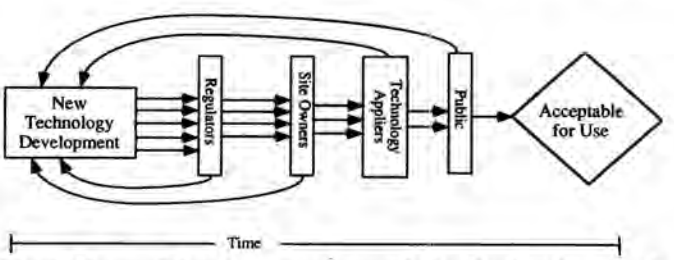

Fig. 1. The traditional approach to stakeholder involvement is a serial process, which leads to extraordinary time and schedule costs.

making process again. Even then, the data developed may be seen as biased for the purpose of selling the technology.

This serial approach to addressing stakeholders' issue is tied to the view that the regulator is the key agent that needs to be convinced a technology is sound (see Fig. 2). In terms of the historic approach to decision making about technology deployment, this seems to make sense because regulators' role has been to make enforcement and compliance decisions and the public's role has been simply to provide input to the decision. Technology developers and deployers have spent considerable time and money seeking the endorsement of regulators. Yet more often than not, technology developers are frustrated because regulators' support does not lead to deployment. Ultimately, the technology is rejected because the public does not accept it.

Fig. 2. Traditional approach: regulators were viewed as the primary decisionmakers regarding acceptance and deployment of new technology.

Incineration provides a telling example. Incineration technologies have good performance advantages and have received regulators' approval for use, yet often these technologies cannot be deployed. In other instances, environmental firms that apply remediation technologies, as well as their clients, are very reluctant without hard performance data to try a new technology even with assurances that regulators will agree to its use. The potential liabilities of a technology not performing are perceived as simply too great to justify the risk. These examples illustrate two important points: first, the decision making process is multifaceted and a range of stockholders' influences the development and deployment decision, and second, the stakeholder involvement is important from the beginning and throughout the technology development process.

NEW APPROACH

The VOC-Arid ID management team recognized the importance of stakeholder involvement and made it an essential task of the ID. The team recognized that early involvement of stakeholders could save both time and money and believed that substantive involvement could enhance the technologies themselves and the likelihood of their acceptance. Yet it was not until the team began to work with stakeholders that they really began to understand how many different stakeholders play a role in decisions to deploy a technology (see Fig. 3). The team learned that these stakeholders generally have similar requirements for information and share concerns about the validity of information as well as its ability to be transferred to different environmental settings. The team operated under the premise that designing the demonstration to respond to the concerns of stakeholders would yield credible results that met their needs. The guiding principle is that involving stakeholders in this new way, assuming that the technology performs adequately, will significantly enhance a technology's acceptance and accelerate the process of its development and deployment.

Fig. 3. New approach: recognizes that numerous stakeholders affect decisions to deploy new technology.

The VOC-Arid ID is making another break with the past by addressing institutional and stakeholder issues in parallel with the development of the technology (see Fig. 4). The approach that has been taken is to define the range of groups and individuals who might have a stake in the deployment decisions. These stakeholders generally fall into the categories of Indian Nations, environmental interest groups, regulators, technology users (environmental remediation firms), and responsible parties for cleanup actions. Numerous meetings have been held with representatives of these groups including 40 individual interviews. The teams' first action was identifying the information they needed to evaluate a technology and judge it fairly for deployment. The second step was to apply these information requirements as criteria to the specific technologies that were planned to demonstrate in order to

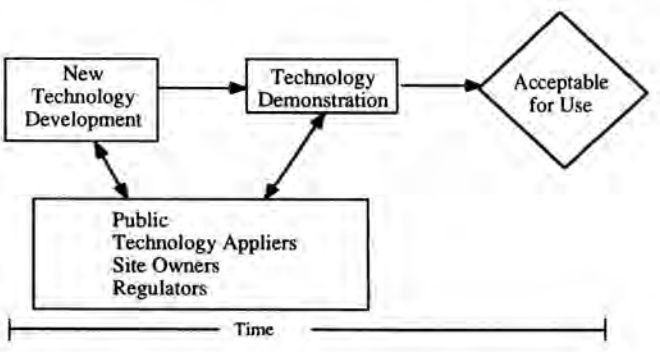

Fig. 4. The new approach brings the stakeholder involvement process up front to operate in parallel with the development process to reduce cost, schedule impacts, and allow reasonable investment decisions.

assure that the data the ID was collecting was the data stakeholders needed.

This approach minimizes the need for multiple demonstrations, and since the stakeholders have participated directly in the demonstration process, they are more likely to have confidence in its results. Early interaction also allows the identification of significant concerns to that these issues can be addressed and so that reasoned investment decisions can be made. In some cases, the information may suggest that a technology needs to be modified to change or eliminate problematic or limiting features. In other cases, the information may suggest a "show stopper," making further investment of time and resources unwise.

Although this concept is simple, this approach challenges both the scientist/engineer and the social scientist to become partners in a manner traditionally foreign to them both. The scientist/engineer must accept the fact that scientific data is only part of the technology development and deployment decision and must be prepared to modify technology to address stakeholders' concerns. The social scientist must understand the science and technology in sufficient detail to translate accurately scientific concepts and parlance to a common language understood by both technical and nontechnical audiences. Social scientists must also press their discipline to understand and asses the magnitude and significance of institutional concerns. Through this cooperation and by addressing technological and institutional issues in parallel, the VOC-Arid ID team should be able to significantly reduce the time required to advance technology from demonstration to deployment.

CONCLUSION

Based on experience to date, this approach is generally successful and gratifying. Contrary to the general view in the scientific community, the interested public is knowledgeable and constructive in its participation. The results of this process are credible and market-driven. Effective stakeholder involvement provides participants with the reliable data they need to make reasoned decisions. Although it does not assure that a technology will be accepted, it does provide early definition of those stakeholders' concerns that impact the acceptance of a technology. In this way, the developers of and investors in a technology gain reliable information that allows timely technological modifications, and if these are not practical, financially responsible decisions to cease development.

Without a new approach that includes early and continuing stakeholder participation, the discouraging record of technology acceptance and deployment is unlikely to improve. When we begin to regard stakeholder participation as valued consulting rather than an obstacle to overcome, we open the door to new possibilities and improved technologies.