



# **Industry Canada**

## **Evaluation of the Electric Power Technology Roadmap**

### **Final Report**

**The Strategic Review Group  
Le groupe de revue stratégique**

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**March 2002**

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## Evaluation of the Electric Power Technology Roadmap

### Final Report

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## **Executive Summary**

This document presents the findings, conclusions and lessons learned from an evaluation of the Electric Power (EP) Technology Roadmap initiative that began in 1996. The EP Technology Roadmap document was produced in 2000.

A Technology Roadmap (TRM) is a tool to help Canadian industries, or sectors within an industry, identify and address the technology challenges that are critical to their future. Phase 1 of a TRM involves determining those key technologies based on the TRM participants' knowledge and analysis of future requirements.

At the time the EP TRM was being developed, the Canadian electric power industry was being deregulated, which led industry to conclude that its future success depended on its technology preparedness. The EP TRM was intended to enable organizations within the industry to achieve a collective decision on future technology development, and to establish a commitment to work together in addressing the related technological challenges. Industry Canada's role in the EP TRM was to act as a catalyst in launching the initiative, and as a facilitator throughout the TRM exercise.

### **Main Conclusions**

In general, the findings indicated that the EP TRM was considered to be a useful exercise and a worthwhile undertaking. It was the first attempt by the Canadian electric power industry to undertake a longer-term technology planning effort.

Phase I of the EP TRM established a successful opportunity for participants to exchange ideas and views on important technology issues, and to capture these in a formal document for industry-wide dissemination. Interviewed participants all agreed that Industry Canada did an excellent job in bringing together participants, and fostering progress throughout the exercise. However, they also indicated that IC did not follow through completely on its commitment to facilitate the TRM and meet participants' expectations.

### **Lessons Learned**

1. A TRM's Phase 1 might be more successful if its timing does not coincide with significant fundamental/structural changes in the concerned industry.
2. A collaborative work environment is an important contributor to the TRM process.
3. Participants in TRM working groups should be involved in the selection of the areas to be studied by the working groups.
4. TRM initiatives can progress more deliberately if Phase 1 produces a formal plan of future projects and working arrangements, including partnerships, for undertaking those projects.
5. Industry Canada performs well the role of facilitator.
6. If the Department chooses to facilitate a TRM exercise, it should ensure that sufficient effort is allocated so that the exercise meets its objectives and those of participants.

# Industry Canada

## Evaluation of the Electric Power Technology Roadmap

This document presents the findings, conclusions and lessons learned from an evaluation of the Electric Power (EP) Technology Roadmap initiative that began in 1996. The EP Technology Roadmap document was submitted in March 2000.

### **Purpose of the Evaluation**

The purpose of the evaluation was to obtain information on the results achieved through Phase 1 of the Electric Power Technology Roadmap, and on the success of the process followed in that first phase. The three phases of Technology Roadmaps are described in the next section.

## **1.0 Overview of Technology Roadmaps**

A Technology Roadmap (TRM) is a process tool to help Canadian industries, or sectors within an industry, identify and address the technology challenges that are critical to their future. Developing and implementing a TRM involves a three-phase process, as follows:

**Phase 1:** Developing a formal TRM for an industry, a sector, or common areas of interest. Results from this developmental phase are captured in a formal Technology Roadmap Report, which is an important deliverable from Phase 1 of a TRM initiative. A Technology Roadmap Report typically captures the following information that was developed during the Phase 1 process:

- 1) The technologies that are critical to future competitiveness of an industry or of related industries, based on the participants' knowledge and analysis of future requirements.
  - 2) Technological requirements and opportunities for the industry's supply chain, and
  - 3) Recommendations for action on how multiple organizations from industry, academic institutions, research organizations, and governments can work together to crack those technologies.
- **Phase 2:** Selecting and undertaking projects identified in Phase 1 of the TRM to "crack" the identified critical technology challenges.
  - **Phase 3:** The adoption by an industry, a sector, and/or others of a "culture of collaborative technology development" as part of their normal method of operation.

The life-cycle of all three phases of a TRM will most often cover a period of several years.

A key characteristic of TRMs is that they are “industry-led.” This approach helps industry “buy-in” to the results, and is a contributing factor for the initiative to proceed through all three phases, ultimately leading to ongoing collaborative technology development.

The process for developing a TRM typically involves several companies from an industry, or one or more industrial sectors within an industry, that come together to identify the technologies that are critical to their collective future, and to establish a collaborative approach to developing those technologies. The key objective of a TRM initiative is to provide a mechanism to enable organizations within an industry or a sector to achieve a collective decision on future technology development, and to establish a commitment to work together in addressing the related technological challenges.

Industry Canada’s role in EP TRM was to act as a catalyst in launching the initiative, and as a facilitator throughout the TRM exercise.

## **2.0 Evaluation Methodology**

The methodology for the evaluation of the EP TRM involved interviews and the review of documents. The list of reviewed documents is included as Appendix A.

Since all TRM’s are expected to be industry-led, and industry is intended to be the main beneficiary of TRM results, interviewees were selected primarily from industry representatives who participated in the EP TRM (utilities were considered as “industry”, even though some were publicly-owned). In addition to the interview with the responsible Industry Canada officer, eleven interviews were held with individuals representing the following types of organizations:

- three utilities
- seven non-utilities companies
- one from the federal government.

The list of interviewees is attached as Appendix B.

## **3.0 Overview of the EP TRM**

The Electric Power TRM was first proposed by Industry Canada in 1996 at the National Electric Roundtable. About two years later, in 1998, after extensive discussions with utility companies, Industry Canada formally launched the TRM initiative.

As a first step, an industry-wide survey was conducted to identify key industry technology issues. The survey results were used to identify issue areas for discussion, and working groups were established to study the selected issues. The TRM report was tabled in March 2000.

This exercise was the first attempt by the Canadian electric power industry to develop a TRM. At the time the TRM was being developed, the Canadian electric power industry was being deregulated, which led the industry to conclude that its future success depended on its technology preparedness.

The TRM was intended to help address the following three questions facing the Canadian EP industry:

- How could the industry reduce the risk of investment in research and development (R&D)?
- How did the industry align R&D investment with true market potential?
- How could the industry sustain meaningful and commercial progress while building on existing competencies and capabilities?

The TRM provided a process to enable industry as a whole to address these questions. Through the TRM, participants analyzed the main challenges facing the industry, focusing on technological trends, markets, and competition facing firms in the EP industry. The analyses conducted by the EP TRM Steering Committee resulted in a final list of four issue areas to be addressed through the TRM. The four identified areas were:

- Asset optimization,
- Intelligent power delivery,
- End-use efficiency, and
- Small-scale generation and renewables.

Each of these areas was examined by a working group of TRM participants.

## **4.0 Findings, Conclusions and Lessons Learned**

It is important to note that the Electric Power TRM has only undertaken Phase 1 of the full TRM initiative. Even though the evaluation findings relate primarily to the first phase, interviewees also provided relevant information related to phases 2 and 3 of the initiative.

In general, the findings indicated that the EP TRM was a worthwhile undertaking. The findings also provided some useful lessons learned that might increase future TRMs' potential to achieve more fully their intended results. The following sub-sections set out the findings and conclusions to support this overall view.

### ***4.1 How Participants Became Involved***

The EP TRM participants were determined through discussions between Industry Canada and industry members.

The selection of participants for the EP TRM consisted of individuals from private sector organizations, academia, and utilities (of which some were privately and some publicly owned). The participants were chosen using two methods: selected participants were either working with an organization "targeted" by Industry Canada as a desired contributor, or they were asked by a member of the working group to participate in the exercise because it was believed that their views were important. Four of the evaluation's 11 interviews became involved in the Roadmap exercise because a colleague in their industry had asked them to do so. About half of the interviewees indicated that they "agreed to participate in

the exercise to be good corporate citizens”, suggesting that they were willing to work with others in the industry and with Industry Canada. It is not clear from the interviews whether these participants fully recognized at the outset the potential value of the TRM exercise. However, during interviews, all understood well and had positive views on the potential benefits from the exercise.

This approach to selecting participants had a positive result inasmuch as the people involved were willing to participate and they represented different sectors of the industry.

#### **4.2 Timing Affects the Success of a TRM**

Interviews indicated that the timing of Phase 1 of the EP TRM exercise affected the success of the initiative.

Interviewees indicated that, at the time of their TRM, the EP industry was undergoing a major change in its business model. Specifically, the utility sector of the industry was in flux, adapting to a deregulated environment. As a result of this change, key industry personnel were focused on the regulatory change, and not fully available to the TRM initiative. That being said, interviewed participants indicated they had followed through on their commitment to develop the TRM, right up until the completion of the EP TRM report. Even though these participants were committed to completing the process, the interviewees did indicate that their efforts waned as a result of their internal work commitments related to the deregulation effort. These views may suggest that the late 1990's – the period during which the exercise was undertaken – might have not been the ideal time to proceed with a TRM exercise for the EP industry. On the other hand, with deregulation, the industry itself had determined that its future success depended on its *technological readiness*. Therefore, a good argument existed for undertaking a TRM at that time.

Despite the competing priorities facing participants, interviewees responded favourably to the concept of the TRM and the reasons for undertaking it. In fact, two respondents said, “It is an exercise worth revisiting now that the deregulation initiative is complete.”

Whether or not the timing of the TRM was optimal, the EP TRM initiative might have added value by encouraging participants *not* to lose sight of the technologies that the industry as a whole needed for future success. On the other hand, the EP TRM might have been more successful if participants had not been distracted by important industry-wide developments. Therefore, based on interviewees' views, it might have been more useful to undertake the EP TRM after the industry overcame its significant challenges related to deregulation.

**Lesson Learned:** A TRM's Phase 1 might be more successful if its timing does not coincide with significant fundamental/structural changes in the concerned industry.

### **4.3 Impact of Technology Roadmaps**

As indicated earlier, interviewees recognized the potential value of the EP TRM. However, they had mixed views about the actual results from the initiative, and this affected their full buy-in to the TRM concept. As discussed in the following paragraphs, a number of participants found that the TRM did not apply to them, and, therefore, were disappointed in the usefulness of the results. Other participants, those who *could* relate to the topics of the TRM (mostly representatives from utilities) had mixed views on the results from the exercise. These are discussed below.

#### **4.3.1 The collaborative effort was useful**

The evaluation indicated that participants benefited from the TRM's collaborative design.

Interviewed participants indicated that the collaborative aspect of the TRM was useful since it provided an opportunity to bring the stakeholders together to discuss views on the relative importance to the industry of specific technologies and key hurdles that needed to be overcome. For example, one interviewee said: "this was an excellent medium to bring us together to see what other firms in our industry were working on."

Even participants who were less directly affected by the issues that the TRM eventually addressed (i.e., participants who were not utility-focused) indicated that the collaborative effort provided an opportunity to discuss technology issues with other industry members.

Overall, the exercise's collaborative approach was an important positive dimension of the EP TRM exercise.

**Lesson Learned:** A collaborative work environment is an important contributor to the TRM process.

#### **4.3.2 The EP TRM Phase 1 results were more useful to some participants than to others**

Findings indicated that the EP TRM was not as useful for technology forecasting for all participants as it could have been. This outcome likely occurred because the TRM's direction did not reflect the interests of all participants.

Some interviewees indicated that, soon after the process began, the purpose of their involvement became unclear. Specifically, they indicated that their segment of the industry did not contribute to the directions that the TRM eventually took. Participants who were *not* utilities believed that the exercise was not relevant to them because the four areas studied had been too "utility-focused". For example, a representative from a wire and cable company would not have much to contribute to a TRM analysis related to power distribution. One interviewee said: "I don't know why I was invited", indicating that, although technically part of the electric power

industry, he believed that he should not have been involved in the TRM. He indicated that he felt this way because the exercise served only one specific segment of the industry, and that the chosen areas for study did not relate to the segment that his company was involved in. Seven of the 9 non-government interviewees were less concerned with the issues facing utilities and, therefore, they believed that their long-term technology concerns had not been addressed at all. Some indicated that the issues discussed had been too broad to be of any use for technology planning.

Therefore, the direction taken by a TRM affects participants' ongoing contribution and commitment. This, in turn, negatively affects participants' willingness to participate in TRM projects in the second and third phases of the exercise.

Interviewees also indicated that participants from other segments of the industry would have been useful to have around the table. For example, several of the interviewees said, "an exercise such as this would benefit by including some of the smaller, more "R&D focused" companies", so that small innovators could also play an active part.

Whether or not the topics selected for the EP TRM exercise were the ones most important to industry, the exercise would have been more useful to participants as a technology-forecasting tool if the selected study areas had been relevant to a greater proportion of those involved. Furthermore, more of the EP TRM participants would feel positively about the value of the overall exercise if the results had been more directly pertinent to them. This, in turn, affects Industry Canada's success in attracting participants to future TRM exercises.

Finally, because of the "disconnect" between the TRM study areas and most interviewed participants' interests, the evaluation was not able to determine the extent to which the output from Phase 1 of the TRM exercise was of value to the EP industry.

Overall, the findings indicate that a TRM Phase 1's success relies heavily on the match between selected participants and selected areas for analysis. For the EP TRM, the study areas were chosen based on an analysis of the views of industry participants across the country. If the selected TRM participants had had more influence in choosing the project areas, then they would likely have been more enthusiastic about the TRM, and would be much more inclined to participate in phases 2 and 3.

**Lesson Learned:** Participants in TRM working groups should be involved in the selection of the areas to be studied by the working groups.

#### **4.3.3 Identifying future technology projects and partnerships**

The EP Phase 1 would have been more useful to industry if a plan for future technology projects and partnerships – an important output from

Phase 1 of a TRM – had been developed. This plan would have provided more clarity to the next steps in the EP TRM.

Phase 1 of a TRM is intended to bring together an industry to collectively discuss technology issues, identify the key technologies for future success, and plan the steps for cracking those technologies. The main elements of these steps include defining a project, and determining the collaborators/partnerships for each project.

As indicated earlier, Phase 1 of the EP TRM generated important positive results. Interviewees indicated that the exercise would have been even more beneficial if specific projects and partnerships had been identified for subsequent TRM activities. They also indicated that these two components had not been explicitly discussed during the TRM exercise. One of the interviewees said, “I did not know that the exercise was intended to identify potential partners.”

Even though there were no formal partnerships created from the EP TRM, some informal ones likely evolved. For example, one of the interviewees said that, just by participating in the exercise, he became aware of the types of work and companies available from elsewhere in Canada. He indicated this was useful since, if the need arose, he would not hesitate to contact those firms to form business partnerships.

Networking and informal arrangement are important results from TRMs, but they do not provide specific guidance for later phases of a TRM. Future phases of the EP TRM might have benefited from a formally developed plan for future projects and working arrangements.

**Lesson Learned:** TRM initiatives can progress more deliberately if Phase 1 produces a formal plan of future projects and working arrangements, including partnerships, for undertaking those projects.

#### ***4.4 Industry Canada’s Role in the TRM Process***

The evaluation determined that Industry Canada fulfilled very well its role as facilitator to the EP TRM. The Industry Canada officers involved in the TRM met, and in some instances exceeded participants’ expectations.

For the EP TRM, Industry Canada was a catalyst with the NER in initiating the TRM. Further, an IC officer acted as a facilitator and encouraged industry participants to participate in the TRM and contribute their resources to form workgroups and define key future technologies to “crack”.

Interviewees all agreed that Industry Canada performed well as a facilitator, as well as a secretariat for the initiative. They said that the Industry Canada officer was successful at providing the working groups with necessary TRM process information, thereby enabling the initiative to proceed. One interviewee captured the theme by saying: “if it was not for Industry Canada, this exercise would not have taken place.” Another said: “the information provided by Industry Canada was well geared to level of those who were participating in the exercise”. The

participants also said that Industry Canada did an admirable job in keeping the roadmap process moving along in a cooperative, unified way.

Some participants indicated that they had expected the TRM initiative to go further than it did, including launching specific technology development projects. Based on the evaluation findings, the reasons the EP exercise ended are not clear. As indicated, some interviewees said that they had competing priorities, which may have eventually overtaken the TRM as a priority. Also, one interviewee indicated the disruption from the January 1998 ice storm in Ontario and Quebec became some organization's first priority, displacing all other time commitments. Finally, many believed that Industry Canada virtually withdrew from the exercise once the TRM document was complete. Some interviewees indicated they had approached IC to discuss next steps, but no further action was forthcoming. Whatever the reason for the TRM initiative not proceeding, the findings suggest that there was an appetite to go further. Also, even though IC was viewed positively as a facilitator for the process, there was a view that the Department didn't follow through, thereby not meeting participants expectations.

**Lessons Learned:**

Industry Canada performs well the role of facilitator.

If the Department chooses to facilitate a TRM exercise, it should ensure that sufficient effort is allocated so that the exercise meets its objectives and those of participants.

## **5.0 Overall Conclusion**

Overall, the EP TRM was considered to be a useful exercise. This was a first attempt by the Canadian electric power industry to undertake a longer-term technology planning effort. Interviewees indicated that the exercise provided an opportunity for the entire industry to examine major technology challenges and to identify the technologies that are key to the industry's future.

Phase I of the EP TRM established a successful opportunity for participants to exchange ideas and views on important technology issues, and to capture these in a formal document for industry-wide dissemination. Phase 1 would likely have benefited from improved matching of projects, working group participants, and industry champions. This might have resulted in a more formal plan of future projects and partnerships, which in turn would have provided a more solid foundation for subsequent phases of the EP TRM.

Interviewed participants all agreed that Industry Canada performed well in bringing together participants, and fostering progress throughout this Phase 1 exercise. However, they also indicated that IC did not follow through completely on its commitment to facilitate the TRM and meet participants' expectations.

## Appendix A – Documents Reviewed

- Future Markets and the Canadian Electric Power Industry: background information for the Technology Roadmap Exercise - Discussion paper prepared by Industry Canada
- Worldwide Technological Developments and Marketing Need: Challenges and Opportunities for the Canadian Electric Power Industry- Discussion paper prepared by Industry Canada
- Technological Monitoring in the Electrical Industry: An International Delphi Survey on Conducting Polymers- Delphi III 1997
- Strategic Analysis of Technological Trends in the Electrical Industry: The Perspective of Experts from 36 Countries - Delphi III 1997
- Electric Power Technology Roadmap: A PowerPoint Presentation - March 4, 1998
- Electric Power Technology Roadmap Workshop Itinerary - October 20, 1999
- Various correspondence
- ADM Memorandum: Electric Power Technology Roadmap Workshop - March 16, 1998
- Electric Power Technology Roadmap Workshop Program Itinerary - March 23-24, 1998
- Public Interest Energy R&D: A PowerPoint Presentation of David A. Rohy - March 24, 1998
- ADM memorandum: Technology Roadmaps- April 4, 2000
- Report: Competitiveness & Technology Workshop, National Electricity Roundtable - April 23-25, 1996

## **Appendix B –Interviewees**

Rudy Lepp, Rudy Lepp Enterprises

Graham Campbell, Office of Energy Research and Development, Natural Resources Canada

Richard Hall, Babcock & Wilcox Canada

Terry Strack, Ontario Power Technologies

Rick Schwartzburg, PRECARN Associates Inc.

Ed Gasior, GRI Canada

Roy Hoffman, CAE Electronics Ltd.

Mike Bell, Innovative Energy Systems

Bruce Anders, Toromont Energy Ltd.

Blair Seckington, Ontario Power Generation

Lauri J. Hiivala, Alcatel Canada Wire