
VII.15 Pathways to Commercial Success: Technologies and Products Supported by the Hydrogen, Fuel Cells & Infrastructure Technologies Program

Marylynn Placet (Primary Contact),
Steven A. Weakley
Pacific Northwest National Laboratory (PNNL)
P.O. Box 999
Richland, WA 99352
Phone: (202) 646-5249; Fax: (202) 646-5288
E-mail: m.placet@pnl.gov

DOE Technology Development Manager:
Fred Joseck
Phone: (202) 586-7932; Fax: (202) 586-9811
E-mail: Fred.Joseck@ee.doe.gov

Project Start Date: August 1, 2007
Project End Date: September 30, 2009

Development and Demonstration Plan. However, it supports the following subtask in Table 4.6.1: “Provide other support to the program and other organizations” (under Task 3).

Accomplishments

- Produced a report entitled, “*Pathways to Commercial Success: Technologies and Products Supported by the Hydrogen, Fuel Cells & Infrastructure Technologies Program*,” describing patents, commercialized technologies, and emerging technologies that have emerged from the HFCIT Program and its predecessor programs.
- Updated the HFCIT technology tracking database containing information on commercial and emerging technologies.

Objectives

This objective of this project is to provide a retrospective assessment of Hydrogen, Fuel Cells & Infrastructure Technologies (HFCIT) Program benefits by tracking commercial successes of HFCIT-developed technologies (and technologies developed by HFCIT predecessors) and estimating the business impacts, when possible. Tracking technologies helps determine the impacts of research and development (R&D) undertaken by the program, develop lessons learned, and guide future program developments. Technology tracking also allows for more effective management of R&D programs and budget defense, and the database developed serves as the institutional memory for the program.

Technical Barriers

This project addresses the following technical barriers from the Systems Analysis section (4.5) of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- (C) Inconsistent Data, Assumptions and Guidelines
- (E) Unplanned Studies and Analyses

Contribution to Achievement Systems Analysis Milestones

This project does not contribute to achievement of any specific milestones listed in the Systems Analysis section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research,



Introduction

The HFCIT Program and its predecessor programs have been conducting a wide range of hydrogen and fuel cell R&D projects, some of which have resulted in patents and/or products now available in the commercial marketplace. This project focused on identifying and describing both patents and commercialized technologies resulting from Energy Efficiency and Renewable Energy (EERE) hydrogen and fuel cell program activities, as well as technologies likely to be commercialized in the near future (called “emerging” technologies).

Once they were identified, Pacific Northwest National Laboratory (PNNL) gathered information on the commercialization status of EERE-developed hydrogen and fuel cell technologies that are on the market, and, when possible, quantified the business impacts (e.g., number of units sold) of these successfully commercialized technologies. Working with the technology vendors, PNNL documented product characteristics, history, applications, capabilities, and benefits.

Approach

To identify and document the commercial and near-commercial (emerging) hydrogen and fuel cell technologies and products that benefited from EERE support, PNNL undertook several efforts simultaneously. The first effort was a patent search and analysis to

identify hydrogen and fuel cell related patents that are associated with HFCIT-funded projects (or projects conducted by DOE-EERE predecessor programs) and to ascertain the patents' current status, as well as any commercial products that may have used the technology documented in the patent.

The second effort was a series of interviews and document reviews to identify and characterize commercial and emerging technologies that have directly benefited as a result of direct funding from the HFCIT Program (or funding from EERE predecessor programs) or from grants under programs such as the Small Business Innovation Research and Small Business Technology Transfer.

Data gathered about the technologies were then entered into a HFCIT Program Technology Tracking Database, a Lotus Notes database that is updated and available on the DOE system. For each of the commercial and emerging hydrogen technologies in the database, a summary description was prepared, edited, and sent it to the industry/research organization point of contact for review and subsequent approval before sending it to HFCIT Program personnel to review.

Results

The first effort for this task, the patent search and analysis, identified 144 patents: 74 fuel cell patents, 49 production/delivery patents, and 21 storage patents. Figure 1 shows the patents awarded in each year, starting with pre-1997 patent awards through 2007. As the figure shows, 2001 and 2006 had significantly more patents than the other years because those were the top award years for both the fuel cell and production/delivery patents. The storage patent awards are spread out over the entire period, with a peak of four awards in 2004.

Three types of organizations received the patents: national laboratories (69 patents), private companies (56 patents), and universities (19 patents). The national laboratories had patent awards for fuel cell and production/delivery technologies that were almost equal to those awarded to private companies in these two areas. The national laboratories had 62% of the awards in the storage area. While the universities received fewer total patent awards, they had 74% of their patents in the production/delivery area.

The national laboratories and private companies both received more than half of their patents in the fuel cell area.

Figure 2 shows the patent award status by use. As the figure shows, three patents are used in commercial products and 19 are part of research now taking place on emerging technologies identified on the technology tracking list compiled. In addition, 34 awarded patents are still being used in research that is more than three years from a commercial product. Of the 118 patents reviewed, 52% are no longer being used in research. This was particularly true in the fuel cell area, where 43 of the 60 patents (72%) are no longer being used in research.

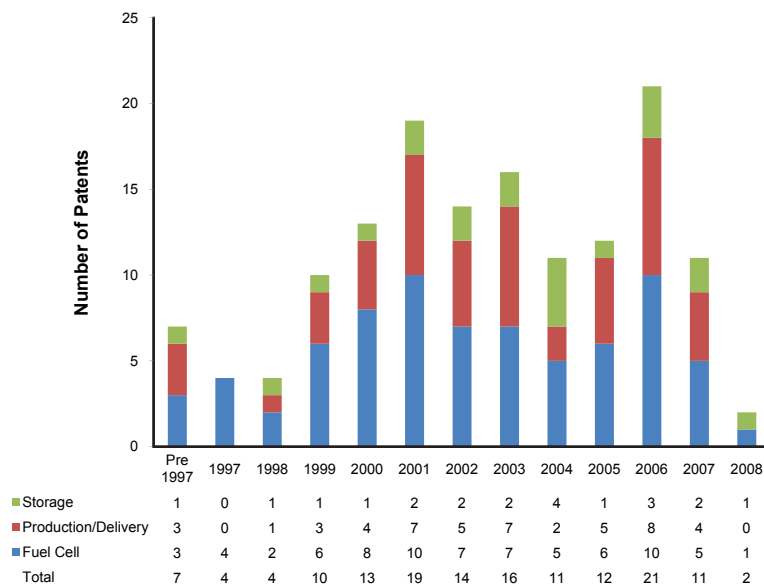


FIGURE 1. Number of Patents Awarded Over Time

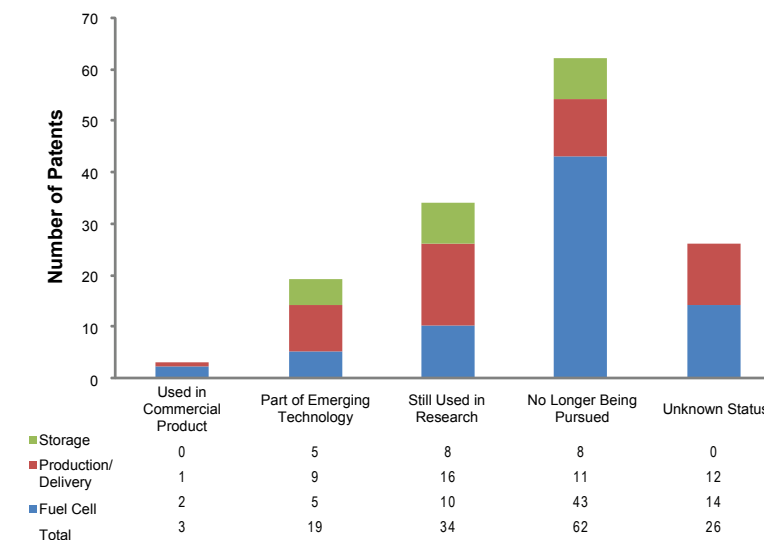


FIGURE 2. Status of Awarded Patents

research. However, this is not true in the storage or production/delivery area, where the patents are still being used in research.

The second effort for this task, identifying the commercial and emerging technologies and tracking results, found 18 commercial technologies and 40 emerging technologies. Figure 3 shows the number of commercial technologies on the market. Years 2000 – 2006 showed a steady addition of technologies entering the market of one to three per year. In 2007 four technologies entered the market, and in 2008 three technologies have done so. Figure 4 shows the distribution of technologies in the HFCIT research areas. As shown, an almost equal number of emerging technologies occurred between the fuel cell and production/delivery areas, with the storage area having only 23% as many emerging technologies.

A total of 40 emerging and 18 commercial technology descriptions were prepared and included in the report.

Conclusions and Future Directions

Commercialization of technologies that were cultivated in a government R&D program is generally viewed as a measure of success. In addition, technology tracking can support:

- Effective management of R&D programs
- Budget defense
- Strategic planning
- Portfolio management
- Institutional memory

The report and technology tracking database will help organizations highlight the impacts and benefits of their products, potentially expanding their markets. It will also help publicize emerging technologies to interested commercialization partners.

The information presented on commercial and emerging technologies fulfills the primary objective – to assess the commercialization status of EERE-developed hydrogen and fuel cell technologies and provide information on the business impacts. Insights about pathways to successful introduction of hydrogen and fuel cell technologies are beginning to emerge from this analysis, but this topic has not yet been fully explored.

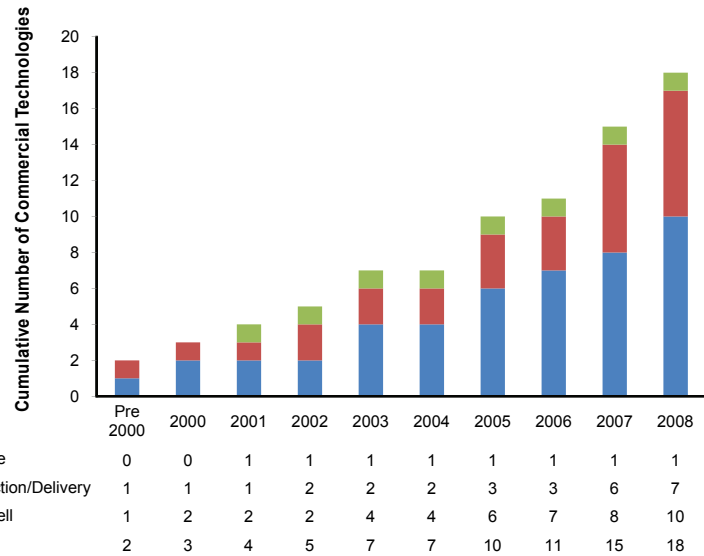


FIGURE 3. Cumulative Number of Commercial Technologies on the Market

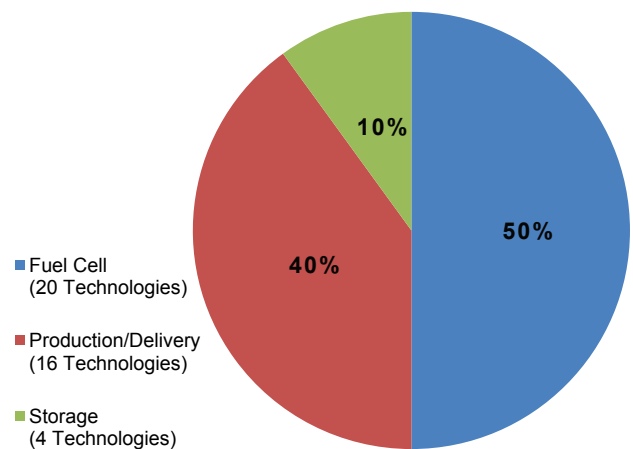


FIGURE 4. Distribution of Emerging HFCIT Technologies

FY 2009 Publications/Presentations

1. Pacific Northwest National Laboratory, *Pathways to Commercial Success: Technologies and Products Supported by the Hydrogen, Fuel Cells & Infrastructure Technologies Program*, draft report to the U.S. Department of Energy Hydrogen, Fuel Cells & Infrastructure Technologies Program, September, 2008.
2. Weakley, S.A., M. Placet, “Pathways to Commercial Success: Technologies and Products Supported by the HFCIT Program,” a poster session at the Hydrogen Annual Merit Review, Washington, D.C., May 18, 2009.