

VII.13 Pathways to Commercial Success: Technologies and Products Supported by the FCT Program

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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 FCT Program and its predecessor programs.
- Updated the FCT technology tracking database containing information on commercial and emerging technologies.



Objectives

This objective of this project is to provide a retrospective assessment of Fuel Cell Technologies (FCT) Program benefits by tracking commercial successes of FCT-developed technologies (and technologies developed by FCT 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 projects 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 Fuel Cell 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 Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan. However, it supports the following subtask in

Introduction

The FCT 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, 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 FCT-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 FCT Program (or funding from EERE predecessor programs) or from grants under programs such as Small Business Innovation Research and Small Business Technology Transfer.

Data gathered about the technologies were then entered into a FCT 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 FCT Program personnel to review.

Results

The patent search and analysis, identified 198 patents: 99 fuel cell patents, 74 production/delivery patents, and 25 storage patents. Figure 1 shows the patents awarded in each year, starting with pre-2000 patent awards through 2010. As the figure shows, 2006 had significantly more patents than the other individual years. The storage patent awards are spread out over the entire period, with a peak of four awards in 2004, while fuel cell and production/delivery patents peaked in 2006 with 12 patents in each category.

Three types of organizations received the patents: national laboratories (100 patents), private companies (76 patents), and universities (22 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 68% of the awards in the storage area. While the universities received fewer total patent awards, they had 59% 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, six patents are used in commercial products and 36 are part of research now taking place on emerging technologies identified on the technology tracking list compiled. In addition, 84 awarded patents are still being used in research that is more than three years from a commercial product. Of the 198 patents reviewed, 36% are no longer being used in research. In the production/delivery area, 73% of the patents are still actively being pursued through use in continuing research, emerging technologies, or commercially

available products. The storage and fuel cell areas also have a majority of their patents being actively pursued.

In the second effort PNNL identified 28 commercial technologies that have entered the market including five using patents identified in the first effort. Figure 3 shows the cumulative number of commercial technologies entering the market. Of the 28 technologies, 27 are still commercially available. Years 2000–2006 showed a steady addition of technologies entering the market of one to three per year. In 2007, and 2008, five and seven technologies entered the market respectively. For 2009 and 2010 the rate of technologies entering the market returned to one to three per year. This effort also identified 52 emerging technologies. Figure 4 shows the distribution of the emerging technologies in the FCT research areas. The number of fuel cell technologies is more than half of the total number of emerging technologies.

A total of 52 emerging and 28 commercial technology descriptions are being prepared and will be included in the updated 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.

FY 2010 Publications/Presentations

1. Pacific Northwest National Laboratory, *Pathways to Commercial Success: Technologies and Products Supported by the Hydrogen, Fuel Cells & Infrastructure Technologies Program*, report to the U.S. Department of Energy Hydrogen, Fuel Cells & Infrastructure Technologies Program, August, 2009.

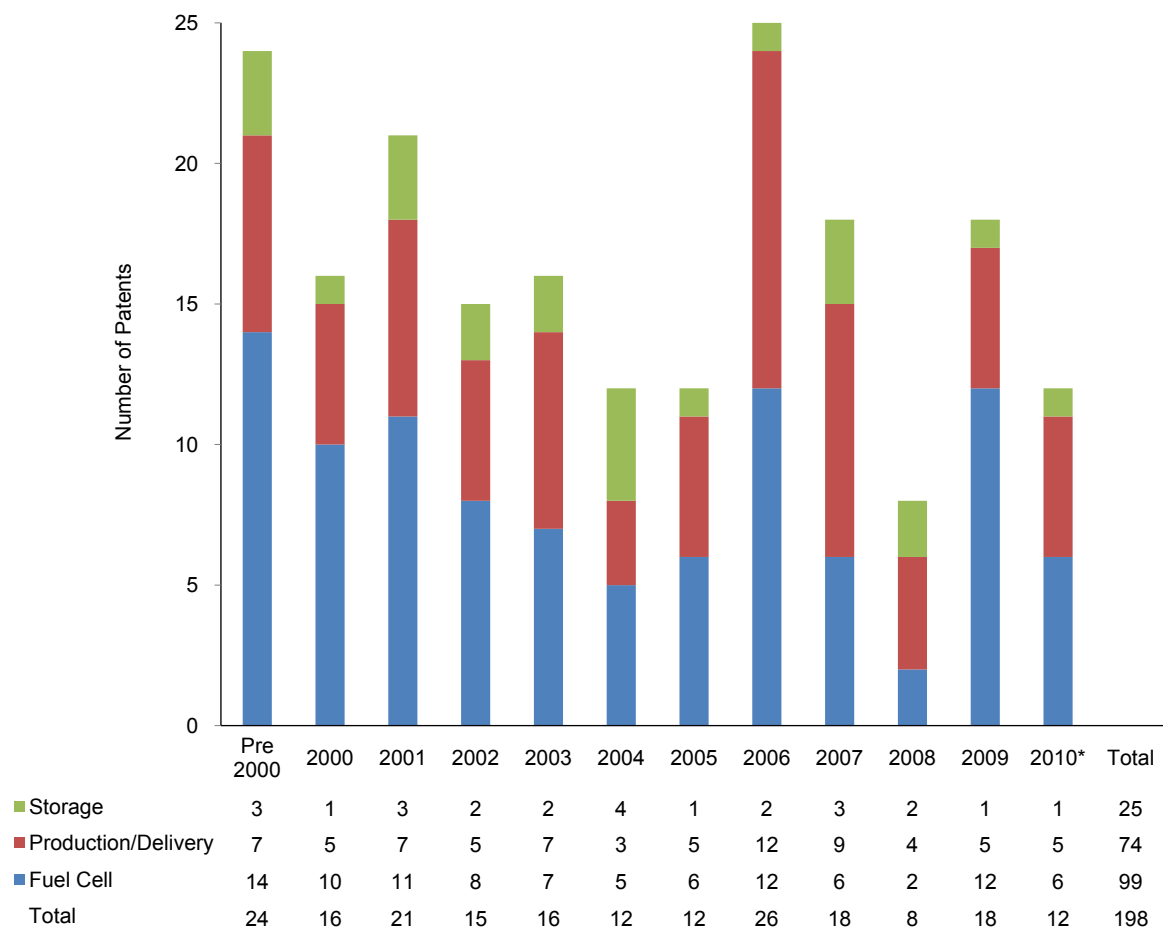


FIGURE 1. Number of Patents Awarded Over Time

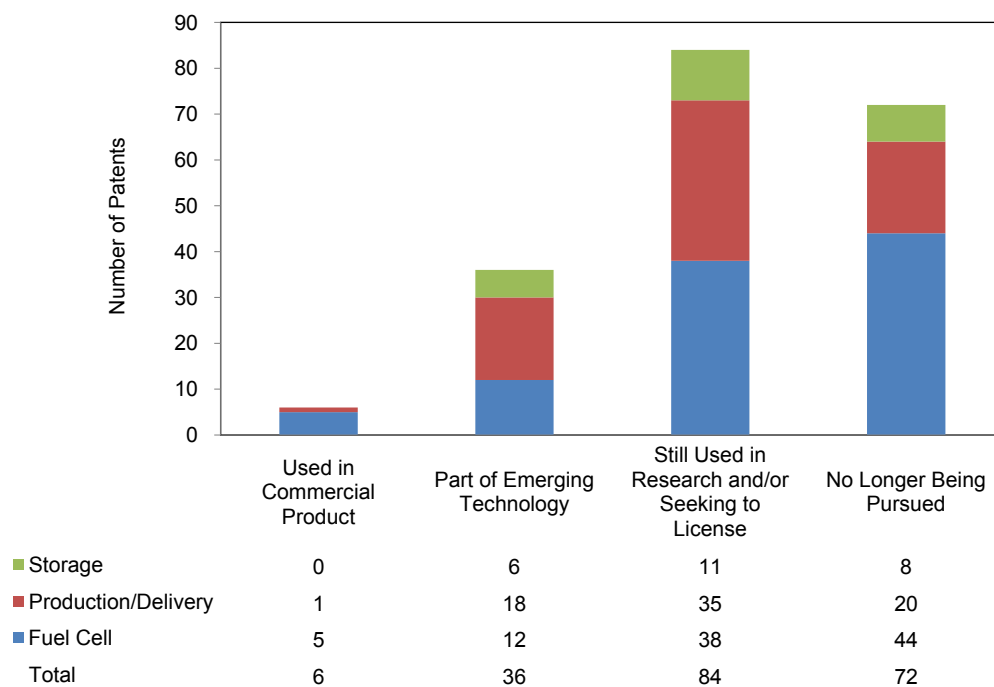


FIGURE 2. Status of Awarded Patents

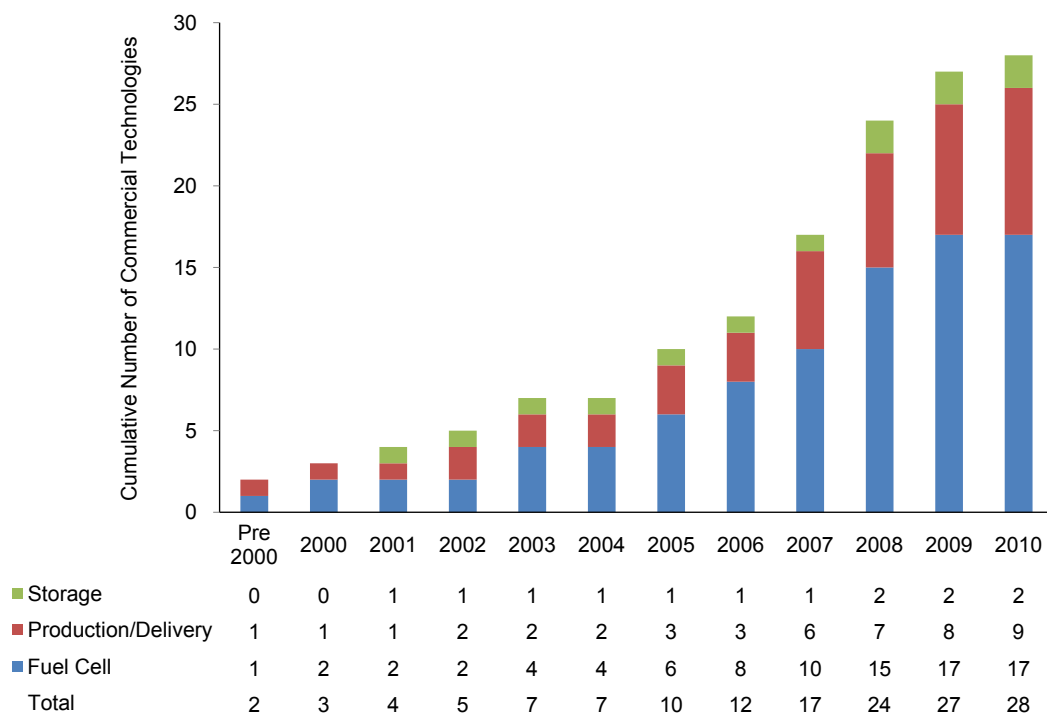


FIGURE 3. Cumulative Number of Commercial Technologies Entering the Market

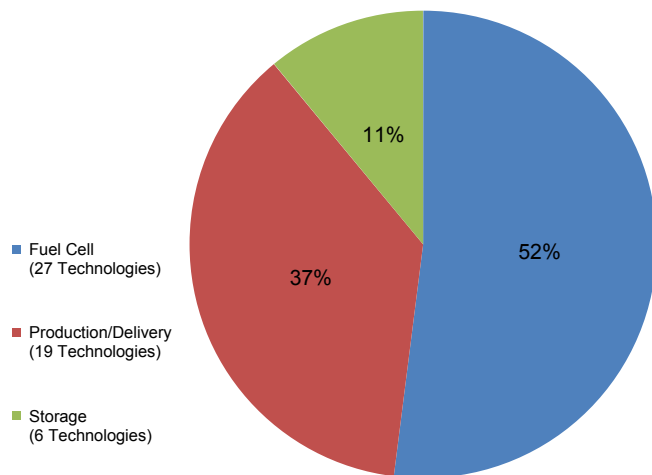


FIGURE 4. Distribution of Emerging FCT Technologies

2. Weakley, S.A., M. Placet, “Pathways to Commercial Success: Technologies and Products Supported by the HFCIT Program,” PNNL-SA-72008, DOE Hydrogen Annual Merit Review, Washington, D.C., June 8, 2010.