



## Fuel Cells: Current Technology Challenges and Future Research Needs

By Noriko Hikosaka Behling

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*Fuel Cells: Current Technology Challenges and Future Research Needs* is a one-of-a-kind, definitive reference source for technical students, researchers, government policymakers, and business leaders. Here in a single volume is a thorough review of government, corporate, and research institutions' policies and programs related to fuel cell development, and the effects of those programs on the success or failure of fuel cell initiatives. The book describes specific, internal corporate and academic R&D activities, levels of investment, strategies for technology acquisition, and reasons for success and failure.

This volume provides an overview of past and present initiatives to improve and commercialize fuel cell technologies, as well as context and analysis to help potential investors assess current fuel cell commercialization activities and future prospects. Crucially, it also gives top executive policymakers and company presidents detailed policy recommendations on what should be done to successfully commercialize fuel cell technologies.

- Provides a clear and unbiased picture of current fuel cell research programs
- Outlines future research needs
- Offers concrete policy recommendations

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## **Fuel Cells: Current Technology Challenges and Future Research Needs** By Noriko Hikosaka Behling **Bibliography**

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### **Review**

*"Behling investigates why the fuel cell...is still not a commercial product in wide use. The topics are fuel cells and the challenges ahead, the history of the alkaline fuel cell, phosphoric acid fuel cells, molten carbonate fuel cells, solid oxide fuel cells, proton exchange membrane and direct methanol fuel cells, strengths and weaknesses of major government fuel cell research and development programs, and policy recommendations."--Reference & Research Book News, December 2013*

*"In the book...Noriko Behling provides a comprehensive history of each major type of fuel cell technology and proposes a bold course of action to address current difficulties in commercialising fuel cells...The book culminates in a set of policy recommendations, which Behling builds towards throughout."--FuelCellToday.com, January 31, 2013*

*"Behling...a science and technology analyst for 30 years, provides a detailed history of the development of fuel cells, emphasizing policy-making aspects. The book starts with two introductory chapters and continues with five chapters (more than 85 percent of the book) on the history of different fuel cell technologies...It is well suited for researchers and policy makers with years of experience and a long-term interest in fuel cells..."--CHOICE, November 2013*

*"Behling (formerly, Central Intelligence Agency), a science and technology analyst for 30 years, provides a detailed history of the development of fuel cells, emphasizing policy-making aspects...It is well suited for researchers and policy makers with years of experience and a long-term interest in fuel cells...Summing Up: Recommended."--Choice Reviews Online, November 2013*

*"This effort is monumental and erudite. It is a tour de force. While presenting the analysis of fuel cell technology that had to be done, the book lays out a research plan that commands attention. The book is highly readable. This is a one of a kind book; no other fuel cell book compares in depth and scope. The author is fierce and hard-hitting, but her conclusions are sound and defensible." – Mark C. Williams, Director, Research, Chief of Engineering Research for URS*

*"This book is a valuable detailed history of fuel cell developments worldwide and proposes policies and important management approaches to be adopted by industries and government. I personally believe that project management must play a critically important role in the successful establishment of fuel cells because of its complexity and the need to coordinate efforts across many different fronts. Fuel cells will provide a paradigm change in energy technology, which has the potential to penetrate deep into modern society. I hope managers in the energy industry and in governments will read this book to learn how to manage fuel cell developments over the long term with enthusiasm and prompt decisions. This book is also written for young people to learn how people failed and succeeded in the fuel cell field." – Harumi Yokokawa, Dr. FECS, Emeritus Researcher, Invited Research Scientist, Project Leader, "Durability/Reliability of SOFC Stacks/System", Energy Technology Research Institute, National Institute of advanced Industrial Science and Technology (SOFC)*

*"A knowledgeable, exhaustive and at the same time relentless review of world fuel cell R&D and the way governments fail to support it properly - controversial and sometimes erring in small details. Essential reading and valuable reference in fuel cell history with a clear vision of how the technology should be further developed to market entry." – Prof.Dr. Robert Steinberger-Wilckens, Chair Hydrogen and Fuel Cell Research, College of Engineering and Physical Sciences, University of Birmingham*

### **About the Author**

Ms. Behling graduated from Tokyo University of Education in Japan with a BA in philosophy. As a Fulbright scholar, she studied linguistics at Washington University in St. Louis and the University of Hawaii, where she earned an MA degree and undertook graduate work toward a PhD.

She worked for the Central Intelligence Agency as a senior analyst and information officer for 20 years. She produced research papers and current assessments in many policy areas, including defense, science and technology, economic policy, and trade issues. Ms. Behling analyzed functional and technical issues, including program analysis, risk assessment, program cost estimation, and global science and technology developments.

She also worked in the private sector for ten years, providing consulting services and analytic support to the Department of Defense and the Intelligence Community in the areas of information technology, nuclear energy, and global environmental technology policy issues, including fuel cell technology, low emission vehicles, and hydrogen energy technology. She assisted the National Security Council to formulate two major R&D policy initiatives implemented by the Department of Energy, the FreedomCar Initiative and the Hydrogen Fuel Initiative.

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