



# HYDROGEN FUEL CELLS

## MARKET OPPORTUNITY PROFILE | JAPAN



### MARKET OVERVIEW

The Japanese market for hydrogen/fuel cell technologies is expected to expand from 1.6 billion yen (C\$19 million) to 78.5 billion yen (C\$95 million) – a 49-fold increase – over the next decade. A number of government measures, including the recent announcement of a Hydrogen Energy Social Infrastructure Development Demonstration Project, which aims to promote the creation of a hydrogen society, along with the auto manufacturers' goal of commercializing fuel cell vehicles by 2015, will bolster this sector through R&D opportunities, commercialization of new technologies and most significantly the development of future hydrogen infrastructure.

Japan's fuel cell sector includes:

- Polymer Electrolyte Fuel Cell (PEFC), which reported 5,055 units shipped in 2009. PEFC units qualify for significant subsidies (up to C\$15,700 per unit – the average unit cost is C\$36,000). The main players in this area are energy suppliers (Tokyo Gas, Osaka Gas, Toho Gas, JX Nippon Oil & Energy, Astomos Energy); manufacturers (ENEOS Celltech, Toshiba, Panasonic); and home builders (Sekisui House, Misawa Homes, Pana Homes). Price reduction will be a major competitive advantage in the future and manufacturers are aiming to reduce prices to C\$6,000 (with subsidies) by 2015.
- Solid Oxide Fuel Cell (SOFC). This sub-sector is made up of an industry consortium (including Kyocera, Toyota, TOTO, Aishin and major gas companies) that is conducting R&D and pilot project experiments for SOFC commercialization.
- Phosphoric Acid Fuel Cell (PAFC). PAFC was one of the earliest types of fuel cells in practical use, and over 200 units with a capacity of 50-200 kW have been deployed as on-site power supply sources for business and industrial use throughout Japan. The major player is Fuji Denki.

- d) Fuel Cell Vehicles (FCVs). The full launch of FCVs in the commercial market is set for 2015 (Toyota has committed to one year earlier, 2014) with 100 hydrogen stations and 2,000 mass-produced FCVs. The main players are: automakers (Toyota, Nissan and Honda); and energy suppliers (JXNippon Oil & Energy, Idemitsu Kosan, Iwatani, Osaka Gas, Cosmo Oil, Saibu Gas, Showa Shell, Taiyo Nissan, Tokyo Gas and Toho Gas). A Japanese public-private initiative is also in place to develop technology to extract high-purity hydrogen for fuel cell cars.
- e) Portable Fuel Cells. Toshiba, NTT Docomo and Aquafairy are the key players involved in R&D for commercialization in this sub-sector. Although development of this sub-sector is only in its infancy, it is one to watch for potential future opportunities.

the number of fuel cell units in use, the “Civil-Use Fuel Cell Introduction Support Subsidy” and a branding initiative named “Enefarm” was launched.

The biggest challenge, and one that provides an opportunity for new competition, is the cost of manufacturing and maintaining PEFCs. With Tokyo Gas leading the charge through a cheaper model anticipated in 2011, other suppliers are expected to follow the trend for a target of 500,000 yen (C\$6,000)/unit price (after subsidy application) by 2015.

### FOREIGN MARKET PLAYERS

A number of foreign companies have penetrated the hydrogen/fuel cell market in Japan in the following areas: hydrogen storage – Advanced and Technical Products (Ireland); Ovonic Hydrogen Systems LLC (U.S.); Dynetek Industries Ltd. (Alberta, Canada); bio fuel cell – Quantum Fuel Systems Technologies World Wide, Inc. (U.S.); indirect fuel cell supply through trading house – Fuel Cell Energy (U.S.); SOFC supplier – NanoDynamics, Inc. (U.S.); and PEFC supplier – Ida Tech (U.S.). Some of the international partnership deals announced in 2009-2010 include:

- U.K. company ACAL Energy received funding from Sumitomo Corporation for the innovative development of low-cost PEM technology
- Hitachi to explore the U.K. market for DMFCs with U.K. firm CPI
- Sapporo Breweries have tied up with Petrobras (Brazil) to test a process of hydrogen production with leftover food
- Wartsila and Hitachi Zosen signed an Agreement on FC power plant solutions in Japan
- Ceramic Fuel Cells Limited (Australia) partnered with Mitsui & Co. and Osaka Gas
- Ceramic Fuel Cells Limited (Australia) sold a unit to Tokyo Gas



## OPPORTUNITIES

Opportunities exist for foreign companies supplying cost-effective advanced technology essential to reducing fuel cell unit prices. Japanese companies are also seeking access to emerging markets in Asia, presenting partnership opportunities in third-country projects. Many types of partnerships are typically formed with or through trading companies or directly with fuel cell system manufacturers.

### FUEL CELL VEHICLES

The primary business opportunity will be in fuel cell vehicles. Toyota Motor Corp., Nissan Motor Co. and Honda Motor Co., along with 10 energy suppliers, recently issued a joint statement on their plan for the full launch of FCVs into the commercial market by 2015. Toyota then committed to a 2014 deadline, which puts the actual R&D deadline at 2013 (in order to commence testing one year prior to commercialization). Japanese gas suppliers and oil companies will also look to build some 100 hydrogen supply stations in four major city areas to prepare for this FCV launch. Given this ambitious goal, Japanese industry and government will be looking for innovative solutions to the current challenges of cost, efficiency and maintenance of FCVs (batteries as well as components unique to FCVs).

In addition to automobile manufacturers, a wide range of industries, including chemical companies and research institutes are working on FCV development. While FCVs represent a potentially significant improvement to the emissions profile, as compared to internal combustion engines, they face competition from other technologies, including hybrid electric vehicles (HEVs) and electric vehicles (EVs).

### PEFC

Reflecting the advanced state of technology development, there has been significant progress in the roll out of PEFCs. Relaxation of the Electricity Business Act and Fire Service Act have enabled PEFCs to become part of the residential energy solution. The industrial use of PEFCs appears to be an area of potential expansion. In 2009, a subsidy scheme was introduced to expand



## REGULATORY/COMPETITIVE ENVIRONMENT

Japan places a high importance on the commercialization of fuel cells and other renewable technologies. A number of government projects and policies have been developed to nurture Japanese expertise in fuel cell technologies through subsidies and tax deductions.

The Ministry of Economy, Trade and Industry (METI), responsible for the development of this industry, has allocated 735.6 billion yen (approximately C\$8.9 billion) toward an Energy Resources Special Account for 2011, an increase of six per cent from 2010. 8,670 million yen (C\$105 million) of this account is appropriated for promotion of the Residential Fuel Cell Cogeneration system through subsidies including:

- a five per cent reduction in corporate taxes
- subsidies to promote low-carbon job-creating industries
- subsidies and taxable income deductions of up to 20 per cent to promote Japan as a hub for Asian operations and for the establishment of high value-added business locations.

The new subsidies and deductions will be available to innovative low-carbon technology-intensive industries involved in product and parts manufacturing for batteries. Further subsidies exist for investment in R&D and manufacturing facilities in Japan.

The Japanese government has also announced a series of projects to study the production, transport, storage and usage of hydrogen including the “Hydrogen Highway Project,” which targets the development of regular expressway services using fuel cell buses/vehicles and the “Hydrogen Town Project,” in which hydrogen is supplied via pipelines for use in general consumer households.

Construction and operation of hydrogen stations are integral to the hydrogen energy social infrastructure, however, there are some significant challenges (most notably the cost of hydrogen station construction – exacerbated by restrictive regulations forcing oversized stations to be built) that will need to be addressed before Japan can see the successful launch of FCVs in the commercial market.



## CASE STUDY

Canadian Xebec Inc. (formerly QuestAir Technologies Inc. of Burnaby, B.C.) has been cultivating relationships with the Japanese hydrogen industry since the early 2000s. In 2004, QuestAir signed with Iwatani International Corporation, the leading supplier of industrial hydrogen in Japan, to provide a hydrogen purifier in a hydrogen power plant in Osaka, Japan. QuestAir’s technology was chosen due to its compact size, ease of installation and operational flexibility, all representing competitive advantages. In 2005, after four years of developing a relationship with Mitsubishi Kakoki Kaisha, Ltd. (a leading supplier of industrial hydrogen plants), QuestAir signed an agreement with the Japanese company to market QuestAir’s hydrogen purification systems in Japan and other Asian countries. In 2008, QuestAir completed another order with Iwatani International Corporation for an H-3100 hydrogen swing absorption system to be used in a hydrogen recovery project in Japan, an order valued at approximately C\$1 million.



## MARKET ENTRY STRATEGY

Japan is a global leader in fuel cell technologies. As such, foreign market participants seeking opportunities in this market must find and address a niche area that is currently not being served by Japanese firms. Like other industries in Japan, the fuel cell sector requires the development and nurturing of long-term relationships with local contacts before commercial partnerships are forged.

Before entering the market, technology testing must be done to Japanese specifications, which are usually far in excess of international standards. The cost of such localization may prove to be a significant barrier to market entry.

The most prudent market entry strategy in this sector is through partnerships with Japanese firms that are well connected in the industry and possess significant experience with local regulatory requirements and issues. Such local partners would assist B.C. firms in localization, integration and commercialization of the technology in question and would assist in communications with Japanese firms (which may not be equipped to communicate in English).

Firms with an interest in Japan should also consider after-market service demands and be ready to provide on-going services during the lifetime of the project for which their technology is being used.

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