Hydrogen in Canada

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Introduction

The objective of the Canadian Hydrogen Association is to promote the use and the development of hydrogen energy, hydrogen energy systems and technologies, and to develop the role of hydrogen energy for the purpose of improving our environment.

This of course is a daunting challenge for a country like Canada, where the per capita use of energy is probably the highest in the world. Canada is the world's fifth largest energy producer. The energy sources produced in Canada are quite diversified: 36% natural gas, 23% oil, 20% hydroelectricity, 11% coal and 4% nuclear. Thus the non-fossil sources account for a quarter of the energy produced in Canada. Most national and international agencies have concluded that global warming exists and that our use of carbon-rich fuel is responsible through the greenhouse effect.

Energy trends

Over the last 150 years, the trend in energy use has been toward reducing carbon consumption and increased use of hydrogen. Each dominant fuel, from wood to coal to oil, and to natural gas– has contained more hydrogen and less carbon.

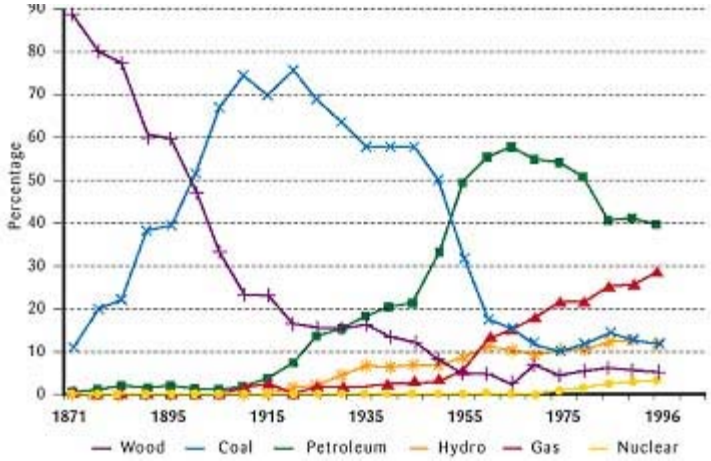

Figure 1. Energy transitions in Canada - primary energy by source from 1871 to 1996, as percentage of the total energy consumption. From Energy Canada 2000.

Each successive fuel has been cleaner and more powerful. This trend is clearly visible in Figure 1. A general trend towards the increase of the H/C (hydrogen/carbon) ratio of the current dominant fuel can thus be observed, as well as a transition from solid fuels to gaseous fuels. The transitions between energy systems have mostly been driven by technological innovation rather than depletion. The H/C increase has been pushed by gains in the gravimetric energy density and in environmental efficiency. The combustion of hydrogen yields three times more energy per unit of mass than petrol and six times more than coal. As environmental issues become more critical in the energy sector, we are most likely to witness the drive towards completing this trend by pushing it to its natural limit: a hydrogen-based, clean and renewable energy system.

Under the Kyoto Protocol (*Kyoto Protocol to the United Nations Framework Convention on Climate Change*), which the Prime Minister has recently announced that Canada will ratify, Canada has agreed to reduce greenhouse gases 6% below 1990 levels in the commitment period 2008 to 2012. CO2 emission reductions will be obtained through domestic emission cuts and pollution credit mechanisms, such as the clean development mechanism, by investing in emission reduction projects in developing countries and in emission reduction projects in developed countries that have taken on a Kyoto target (joint implementation), as well as international emissions trading.

The credit mechanisms of the Kyoto accord and the direct reduction of CO2 emissions by Canada represent unique opportunities for Canadian environmental and energy technology firms. Collaborative projects with partners in developing countries that fall within various pollution credit mechanisms of the Kyoto accord, such as developing clean energy in emerging economies and using the excess power for hydrogen production, will directly benefit Canada. These benefits stem from both the emission credits gained and from the export of new clean energy technologies where Canada has an edge, such as electrolysers and fuel cells.

The Canadian Hydrogen Industrial and R&D Capacity

Canada has become a world leader in the development of hydrogen energy technologies. The Canadian Hydrogen Energy Industry is involved in virtually all fields, including fuel cells, fuel cell systems, electrolysers, fuelling stations, storage technologies (compression and sorption storage) and safety assessments. According to Fuel Cell Canada (*The Canadian Fuel Cell Industry, a Capabilities Guide; Fuel Cells Canada, June 2002*), there are 13 companies focusing on fuel cell production or system integration, and 28 other firms and organisations heavily involved in the hydrogen and fuel cell industry. They contributed about 275 million dollars per year to the economy, employing about 1800 people in 2000-2001.

Canada also benefits from major University and Government R&D Centres, such as the Institute for Integrated Systems at the University of Victoria (IESVIC), the Centre for Hydrogen and Electrochemical Studies at the University of Toronto and the Institut de recherche sur l'hydrogène at the Université du Québec à Trois-Rivières. R&D activities are also performed at government sponsored labs such as at the National Research Council Innovation Centre in Vancouver, and Canmet. In addition, networks of researchers, such as the Automobile of the 21st Century Centre of Excellence and the Québec Research Network on Fuel Cells and Hydrogen, and University Chairs have been established throughout Canada to facilitate collaborative work.

Canada-Japan partnership through PATH

Canada and Japan share a longstanding interest in hydrogen energy technologies, and have shown a clear commitment in deploying these technologies. It is in the best interest of both countries, in the light of the Kyoto commitments, to join forces to reduce as much as possible the transition time to a clean energy system.

In this context, the CHA, the National Hydrogen Association of the United States and the Hydrogen Energy Systems Society of Japan have formed the Partnership for Advancing the Transition to Hydrogen (PATH).

The purpose of PATH is to offer a technical, scientific and commercial forum to discuss and implement means to advance the transition to a hydrogen economy, through regular meetings in order to hasten the advent of hydrogen on the energy market. Through PATH, National Associations representing the Hydrogen Industry stakeholders (producers, users, carriers and regulators) can exchange information on the scientific, technical and commercial aspects of hydrogen production, transportation, safety and use. PATH will disseminate scientific, technical and commercial information regarding the production, transportation and use of hydrogen to government and the general public, particularly in the US, Canada, Latin America, Japan and countries of the Pacific Rim. PATH will stimulate the recognition and use of hydrogen as an abundant, safe and environmentally friendly energy carrier. In particular, PATH will contribute to the development of the hydrogen infrastructure through the establishment, where needed, of national hydrogen associations and by promoting hydrogen energy industries in developing countries of Latin America and of the Pacific Rim.

PATH may thus contribute to curb the rapidly rising CO2 emission curves in developing economies, and help create a new energy infrastructure, based on clean energy, in places where it may be easiest to institute.