Regulations, Codes and Standards (RCS): Where we are, where we are going and how research can help

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ABSTRACT

The world is steadily moving into a post-fossil fuel age. A sustainable new energy mix will no doubt comprise of a number of energy solutions. When combined with wind and solar, which are intermittent sources of energy, hydrogen offers a pathway to provide a steady supply of energy for use in transportation, stationary and distributed power and other applications.

The presentation will discuss the importance of international cooperation in the development of regulations, codes and standards on hydrogen and fuel cell technologies. Indeed, to achieve the initial rollout of hydrogen fuel cell vehicles and fuelling infrastructure planned for 2015 to 2020, it is essential that we try to remove non tariff barriers by harmonizing RCS to enable the advancement of these new technologies to the next level of deployment.

This presentation will provide an update of where we are in terms of available RCS. Research and Development (R&D) has a role to play in the development of RCS. The challenge is how to align R&D activities with filling knowledge gaps identified by the RCS community.

HYDROGEN, PART OF THE NEW ENERGY MIX

Due to considerations associated with climate change and security of energy supply, the world is steadily moving into a post-fossil fuel age. There is a general consensus that the emerging energy mix will comprise of a number of energy solutions such as wind, solar and other new energy technologies, including hydrogen.

Hydrogen, being a universal energy carrier, provides a pathway for renewable energy to generate transportation fuel, reliable power and distributed energy. It is one of the solutions that can be used to overcome the storage challenge faced by the use of intermittent renewable energy sources.

Although hydrogen, fuel cell and renewable energy technologies present environmental and societal benefits, business as usual will not ensure that the energy paradigm shift happen in the timeframe that is needed to overcome the climate challenges. ***The leadership of government and industry will have to work together to enable this energy shift by creating policies where such a transition is possible.***

For instance, one of the challenges is to create conditons to foster the global harmonization of regulations, codes and standards (RCS) and enhance cooperation between RCS and R&D activities so that the R&D work is aimed at filling knowledge gaps in technology as well as those identified by RCS.

GLOBAL HARMONIZATION OF REGULATIONS, CODES AND STANDARDS (RCS) - A NECESSARY STEP TO COMMERCIALIZATION

It is well recognized that a major barrier to commercialization of hydrogen and fuel cell technologies is the lack of globally harmonized RCS. The existence of non-harmonized standards for a given product in different countries or regions contributes to the so-called Technical Barriers to Trade (TBT). Indeed, fair competition needs to be based on clearly defined common references that are recognized from one country to the next and from one region to another. International standards, developed by consensus among trading partners, serve as the language of trade and represent a key ingredient of the *World Trade Organization's* (WTO) *Agreement on Technical Barriers to Trade (TBT)*

The *International Organization for Standardization* (ISO) together with the *International Electrotechnical Commission* (IEC) have built a strategic partnership with the WTO. This partnership aims to avoid the proliferation of TBTs, which generally result from the preparation, adoption and application of technical regulations and standards in a discriminatory manner.

The TBT agreement recognizes the important contribution that international standards make towards facilitating international trade. Where international standards exist or their completion is imminent, the TBT agreement requires that member countries use them as a basis for the standards that they develop.

The TBT agreement also aims at the harmonization of standards on as wide a basis as possible, encouraging all member countries to participate in the development of international standards.

INTERNATIONAL BODIES RESPONSIBLE FOR THE STANDARDIZATION OF HYDROGEN AND FUEL CELL TECHNOLOGIES

ISO and IEC play an important role in the development of international standards for hydrogen and fuel cell technologies. ISO/TC 197, which is one of the 214 technical committees of ISO, is responsible for the development of international standards for hydrogen technologies. IEC/TC 105, which is one of 95 technical committees of IEC, is responsible for the development of international standards for fuel cell technologies.

Both of these technical committees are very active. Each has a work program to meet the current stakeholders' needs in terms of international standards. For more information, please visit the web site of the respective organizations (ISO: www.iso.ch and IEC: www.iec.ch).

In a nut shell, the ISO/TC 197 work covers infrastructure, automotive and transportable hydrogen applications while the IEC/TC 105 work covers stationary, transportation, portable and micro fuel cell applications.

NEED FOR ENHANCED INTERNATIONAL COOPERATION IN RCS

Although all the instruments are already in place to facilitate global harmonization of RCS, further effort is required. This is the acknowledgment that emanated from the *Roundtable on Advancing Commercialization of Hydrogen and Fuel Cell Technologies, a part of the new energy mix, through international cooperation of Regulations, Codes and Standards (RCS)* that was held as part of the 2009 European Future Energy Forum on 10 June 2009 in Bilbao, Spain.

The participants of this roundtable agreed that it was important to create a willingness on the part of decision-makers to work towards the ultimate goal of «*One product, One standard*» that is so critical for the large-scale deployment of the hydrogen and fuel cell technologies.

The key to this effort resides in the commitment of high level government and industry representatives themselves. They need to recognize the need to achieve global harmonization of RCS for hydrogen and fuel cell technologies and to provide the necessary resources and drive in support of international cooperation. It is only through this kind of cooperation that a full set of globally harmonized RCS will be available when the technologies are ready to enter the market.

INTERNATIONAL COOPERATION BETWEEN RCS AND R&D

International coooperation in RCS also needs to be backed by international cooperation in R&D. More specifically, cooperation is required between the global RCS bodies such ISO and IEC and the global R&D organizations such the International Energy Agency (IEA).

It is well known that standardization activities foster cooperation in the spheres of intellectual, scientific, technological and economic activity. As the standardization is undertaken simultaneously with technology development, the standardization work guides technical work and accelerates the development of products.

The development of standards before the introduction of products corresponds to a tendency that is established more and more firmly in standardization. In the past, when a standard was written, it was based on products already available in the market place. This has caused many compatibility problems, which should be avoided for any new technology that is to be used worldwide.

A proactive approach is now essential and there are clear advantages for the industry to having standards defining the minimum requirements for a product simultaneously with product development. One element is requried as a prerequisite for success: There is a need to align the R&D activities so that they fill the knowledge gaps in technology and also those identified by the RCS community.

On many hydrogen safety issues, there are gaps in the knowledge base that need to be addressed through research before they can be addressed in international standards. R&D work generally requires experimental activities that are resource based and time consuming. It is therefore essential to ensure that the R&D work is fully in line with the needs expressed by the RCS bodies to cover knowledge gaps. At the same time, it is also vital to have a process to ensure that the results of R&D are validated and then communicated to the RCS bodies.

In the current state-of-the-art, knowledge gaps still need to be addressed in many areas. For example, R&D work is required to better understand the degradation mechanisms that can affect composite cylinders used for the high pressure storage (70 MPa) of hydrogen. This knowledge is required to develop enhanced design requirements and testing procedures that can be incorporated into international standards with the view to ensuring the mechanical integrity of these cylinders throughout their service life.

R&D work is also required to fully understand the impact of hydrogen fuel impurities on fuel cells and to develop appropriate methods for testing hydrogen fuel quality.

The safe use of fuel cells indoors also presents some challenges. R&D work is required to close the knowledge gaps in hydrogen dispersion, fire, and explosion in confined spaces. The objective would be to develop prevention and mitigation measures that can be included as part of the indoor installation requirements for fuel cell systems.

R&D work is also required to support the development of international standard for hydrogen refuelling stations (HRS). More specifically, R&D is required in order to establish risk-informed separation distances for each type/category of equipment to allow more flexibility in the design

of the fuelling stations without compromising the safety of the installation. This work will be a major enabler in the challenge to build these hydrogen fuelling stations in large cities.

Further work is also required to come up with a maintenance-free seal on refuelling connectors and an appropriate fuelling protocol that will allow fast filing of vehicles without compromising the safety of the fuelling operations.

CONCLUSION

The large-scale deployment of hydrogen and fuel cell technologies is anticipated to begin around 2015 – 2020 timeframe. In the meantime, a collective effort needs to be made to prepare a comprehensive set of globally harmonized RCS that will facilitate the commercialization of these technologies. In order to achieve this goal, close cooperation is required between RCS and R&D organizations to ensure that innovation is translated into safe and efficient products and services.

It is only through a truly international spirit of cooperation that all this work can be achieved within the timeframe needed by industry. Decision makers have a key role to play as success involves moving away from current trends and business as usual. It is however not an impossible task; other industry sectors such as the telecommunication industry have successfully overcome this challenge in the past. We should be inspired by their success.

NOMENCLATURE

authority: body that has legal powers and rights (Reference: ISO/IEC Guide 2, Clause 4.5)

NOTE: an authority can be regional, national or local.

code: document that recommends practices or procedures for the design, manufacture, installation, maintenance or utilization of equipment, structures or products (Reference: ISO/IEC Guide 2, Clause 3.5)

regulation: document providing binding legislative rules, that is adopted by an authority (Reference: ISO/IEC Guide 2, Clause 3.6)

standard: document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context (Reference: ISO/IEC Guide 2, Clause 3.2)

REFERENCE

International Organization for Standardization, ISO Guide 2:2004 *Standardization and related activities – General vocabulary.*

Randy Dey is President of the CCS Global Group, a strategy consulting company established in 1977. He is an expert in international regulations, codes and standards (RCS) development, harmonization and compliance with a focus on hydrogen, fuel cell and other sustainable energy technologies. Mr. Dey holds leadership positions in several RCS forums including chair of the ISO committee on Hydrogen technologies (ISO/TC 197), chair of Canadian Hydrogen installation Code (CHIC), and chair of the Canadian committee on Fuel Cell technologies (IEC/TC 105).