Online Workshop and Panel Discussion

Ontario Tech UNIVERSITY

Hydrogen Energy Technologies: Challenges and Opportunities

Date : Wednesday, January 13, 2021

Start: 08:00 Finish: 18.00

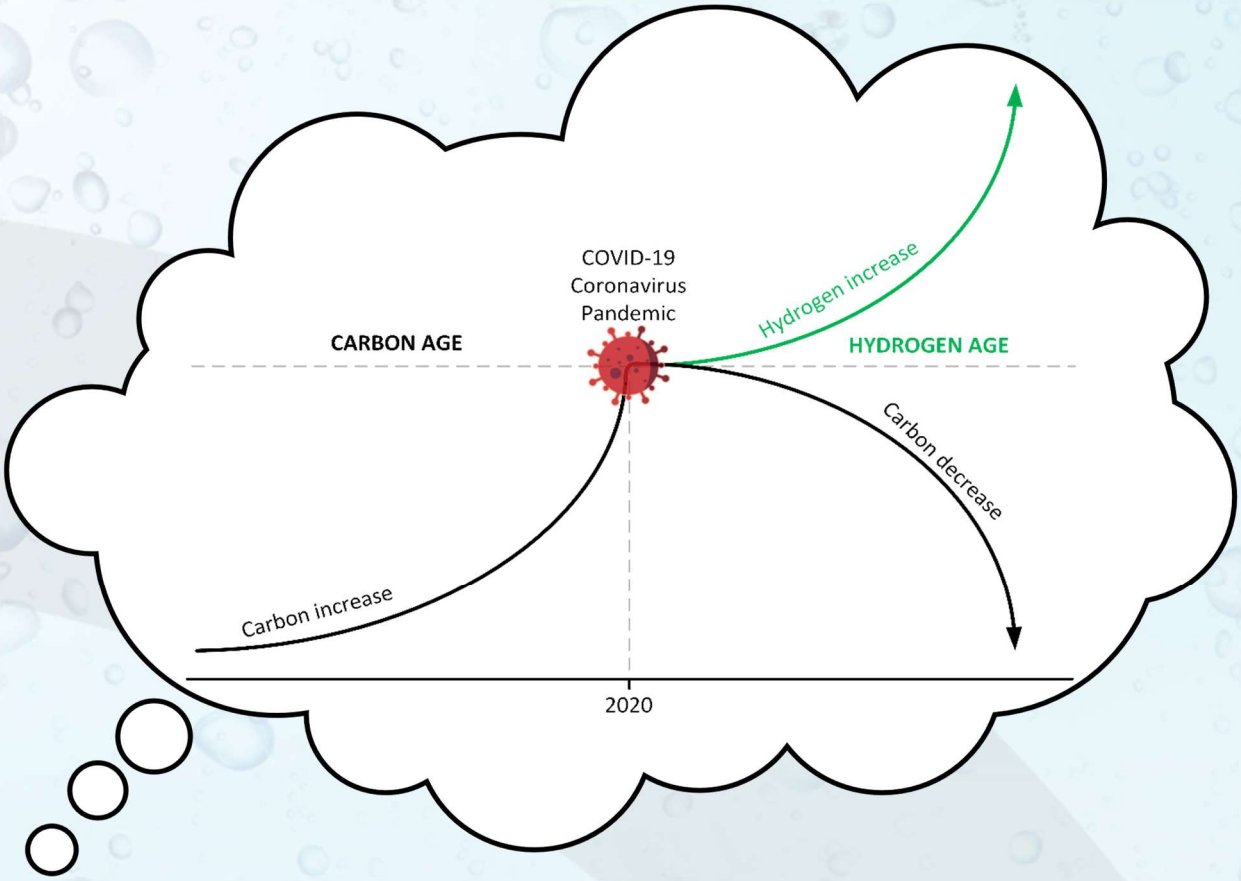
For registration and participation

https://bit.ly/hydrogen-engineering

Please contact hydrogen.engineering@ontariotechu.ca for any inquiries.

Organized by

OntarioTech Engineering & Applied Science



Preface

Ontario Tech University is organizing a unique event on "Hydrogen Energy Technologies: Challenges and Opportunities" at a time when there are attempts provincially and federally to develop strategic plans and the aim to bring key researchers, project leaders, policy makers, strategists, as well as experts, to discuss such a significant topic from every perspective, covering a number of hot topics ranging from; hydrogen production to its utilization, codes and standards, safety, innovation, commercial viability, as well as initiatives from local to global economies. This is a timely initiative to reinforce the strong commitment of Ontario Tech University to hydrogen energy technologies. Our Clean Energy Research Laboratory (CERL) is a hub for this.

I would like to take this opportunity to thank Prof. Ibrahim Dincer who has been coordinating this event to ensure a great success with his organizing committee.

I would also like to take this opportunity to register my sincere appreciation to the distinguished speakers, panelists, session chairs and the panel moderator.

I hope each of you will find this event fruitful and productive.

Hossam Kishawy
Professor and Dean, Faculty of Engineering and Applied Science, Ontario Tech University

Program

Opening Speeches

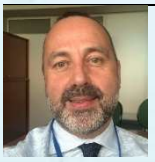
	**Steven Murphy**, Professor, President and Vice-Chancellor **Ontario Tech University**	
	**Les Jacobs,** Professor and Vice President, Research & Innovation **Ontario Tech University**	**08.00 – 08.25**
	**Hossam Kishawy**, Professor and Dean Faculty of Engineering and Applied Science **Ontario Tech University**	

Invited Presentations

Introduction by President Steven Murphy

	**Feridun Hamdullahpur** *Professor, President and Vice-Chancellor,* University of Waterloo, Ontario, Canada	**Energy Pathways to a More Sustainable Future** This presentation provides a realistic analysis of the most up to date energy supply and demand picture and projections for the next decade. The current status of renewable energy capacity and potential of growth technologies will be incorporated into the possibility of carbon neutrality for many nations by 2050. To reach this goal, institutions and, more broadly, nations will need to align foundational directions that increase priority, improve transparency, provide financial support, and build capacity. These require action along several distinct carbon reduction pathways including efficiency improvement and reduction in energy consumption.	**08.25 – 09.00**

Session 1-Chair: Hossam Kishawy

	**Henri Paillere** *Head of the Planning and Economic Studies Section,* International Atomic Energy Agency, Austria	**Towards net-zero objectives through low-carbon hydrogen in integrated energy systems** Decarbonizing non-power sectors such as transport, industry and building will require electrification (with low-carbon power) and the use of low-carbon energy vectors to substitute fossil fuels for the hard-to-abate applications. Hydrogen is increasingly seen as key to the success of the clean energy transition, provided it can be produced without any CO_2 emissions. Electrolysis using low-carbon electricity, whether produced from renewables or nuclear, could be the solution. Furthermore, coupling of the electricity sector to the non-power sector through H2-producing electrolysis could also yield benefits in terms of overall system costs, as suggested by modelling analysis.	**09.00 – 09.30**
	**Volodymyr A. Yartys** *Professor Senior Scientist,* Institute for Energy Technology, Norway	**Hydrogen Storage: Challenges and Opportunities** To enable the wide-spread commercialization of hydrogen fuel cell technologies, the primary focus of R&D of hydrogen storage technologies is in a development of both small and compact H_2 storage solutions enabling efficient use of fuel cell electric vehicles, and also large, on a scale of tons of H_2, hydrogen stores where it can be accumulated over long periods of time, allowing efficient integration of variable renewable energy into the energy system for generate power and heat. The talk will review various alternatives in hydrogen storage solutions. An outlook is presented for future prospects and research on hydrogen-based energy storage.	**09.30 – 10.00**

Short Break **10.00 – 10.10**

Session 2-Chair: Martin Agelin-Chaab

	**John W. Sheffield** *President,* International Association for Hydrogen Energy *Professor,* Purdue Polytechnic Institute, Engineering Technology, Purdue University, Indiana, USA	**Greening of Mining Fleets: A Race-to-Zero Student Design Project** The "Race-to-Zero" initiative provided the inspiration for a Virtual Experiential Intercultural Learning student design project. This multi-semester project is an international collaboration between two Peruvian universities, La Universidad de Ingeniería y Tecnología and La Universidad Nacional de Ingeniería and Purdue University. The goal is to integrate hydrogen fuel cell technologies with a solar photovoltaic microgrid for a proposed mining operation in Peru. Phase One focusses on the system integration of the remote solar photovoltaic microgrid for the trolley charging system of the fleet of electric-drive mining haul trucks. Phase Two focusses on the conversion of the diesel electric-drive to hydrogen fuel cell electric-drive mining vehicles.	**10.10 – 10.40**
	**Mark Kirby** *President and CEO,* Canadian Hydrogen and Fuel Cell Association (CHFCA), Canada	**Canada's Hydrogen and Fuel Cell Sector** The Canadian Hydrogen and Fuel Cell Association is the voice of Canada's world-leading hydrogen and fuel cell sector. With roots going back decades, Canadian companies offer a broad range of products and services across the hydrogen/fuel cell value chain to clients around the world. But now, the focus is shifting to Canada. The Hydrogen Strategy for Canada recognizes the essential role of hydrogen in achieving net-zero 2050, the enormous business opportunity for Canadian companies and the choice it provides Canadians looking to decarbonize. Learn about activities across the country in support of hydrogen energy commercialization.	**10.40 – 11.10**
	**François Girard** *Ph.D., Technical Leader* Hydrogen and Fuel Cells, Energy, Mining & Environment Research Centre, NRC, Government of Canada	**Hydrogen Technologies Research at NRC** Hydrogen is seen by many countries, Canada included, as an essential component to meet GHG emissions reduction. Canada has worked for the last three years to build its Hydrogen Strategy and is home to many global leaders in this sector. NRC has been involved in hydrogen and fuel cell R&D for over 20 years. In more recent years it has reshaped its R&D under programs with specific missions and objectives. This presentation will discuss NRC's current and planned R&D activities on hydrogen technologies aligned with the Canadian government's climate action plan and priorities.	**11.10 – 11.40**
	**Todd Young** *Senior Advisor to the Executive Chairman,* De Havilland Aircraft of Canada Limited, Canada	**Canadian Sustainable Aviation Flight-Demonstrator & Ecosystem (CSAFE) and the Role of Hydrogen** As of 2019, aviation accounted for over 2% of total carbon emissions globally. ICAO predicts that global aviation emissions could triple by 2050 if this trend continues unabated. A paradigm shift is needed through technology injection if aviation is going to succeed in mitigating its environmental footprint. (i) Hybrid Electric & Hydrogen Combustion/Fuel Cells are poised to become key enablers of this technology disruption. (ii) The creation of a national ecosystem for sustainable aviation called the "Canadian Sustainable Aviation Flight-Demonstrator & Ecosystem (CSAFE) is on the horizon.!!	**11.40 – 12.10**
	**Robert Stasko** *Principal and CEO,* Science Concepts International (SCI), Canada *Founder,* Zero Carbon Solutions, Canada *Executive Director,* Hydrogen Business Council (HBC), Canada	**Hydrogen Technology Policy Recommendations as Provided to Government by HBC** The Hydrogen Business Council HBC) has been very active in 2020 (and now in 2021) to engage with government decision makers and policy developers on the subject of a hydrogen strategy. Our mission is to promote the development, deployment and implementation of hydrogen projects in Ontario and in Canada. We have had early successes in representing the hydrogen industrial sector in this province, which includes technology developers, equipment suppliers, hydrogen producers, H_2 end users, academia and public stakeholders writ large.	**12.10 – 12.40**

Lunch Break **12.40 – 13.30**

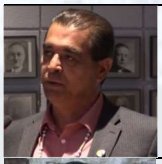
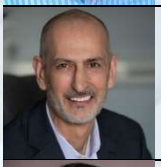
Session 3-Chair: Daniel Hoornweg

	**Andrei V. Tchouvelev** *Founder, President & CEO,* Center for Hydrogen Safety and Codes & Standard, Canada	**Hydrogen Safety and Standards** The focus of this lecture will be to review the key aspects of hydrogen safety and standards such as: behavior and properties, flammability and combustion; hydrogen fueling and vehicle interface; international standards for H2 (ISO/TC 197 program); national and bi-national standards (BNQ CHIC and CSA Group HGV 4.x series); and global technical regulation (UN GTR 13).	**13.30 – 14.00**
	**Xianguo Li** *Professor,* Department of Mechanical and Mechatronics Engineering, University of Waterloo, Ontario, Canada	**Development of advanced MEAs for Next-Generation PEM Fuel Cells** PEM fuel cell has reached its early stage of commercialization, and further improvement is required in performance and durability with reduced cost for widespread commercial applications. The key is to develop highly-performing, durable and economic catalysts, and membrane-electrode assemblies (MEAs) based on the advanced catalysts developed. On the other hand, catalysts with high activities may not necessarily result into MEAs with desired performance attributes, in fact may often end up with inferior MEA products. This presentation will outline technical challenges to and difficulty in the development of advanced catalysts for practical fuel cells, the design and manufacturing of the MEAs with different catalysts, including catalyst ink preparation, mixing, conditioning, and MEA fabrication processing.	**14.00 – 14.30**
	**Esmaeil Navaei Alvar** *Senior Research Engineer,* Ballard Power Systems Vancouver, British Columbia, Canada	**Fuel Cells for Zero Emission Heavy Duty Applications** Ballard Power Systems is a world leader in fuel cell stack and system development for motive and heavy duty applications. Recent studies suggest that within the next 10 years, the total cost of ownership of fuel cell vehicles will be significantly reduced and this will be driven, in part, by a forecasted ~70% decrease in the cost of fuel cell systems. This talk will provide an update on current fuel cell industry status, with a focus on heavy duty motive applications, and how these applications will benefit from next generation fuel cells.	**14.30 – 15.00**
	**Ibrahim Dincer** *Professor of Mechanical Engineering,* Faculty of Engineering and Applied Science Ontario Tech University, Ontario, Canada	**Innovative Hydrogen Technologies Research at CERL** This presentation will focus on three key topics: (i) clean hydrogen production systems, covering high temperature electrolysis, thermochemical/hybrid cycles, photo-catalytic and photo-electrochemical processes, microwave processing, aluminum-water reactions, etc., (ii) ammonia production and utilization technologies, including ammonia fuel cells, and (iii) alternative/synthetic fuels, such methane, methanol, ethanol, DME, etc. It will also discuss some local and global hydrogen initiatives, research, development, innovational and technological developments, new methods and processes in hydrogen energy systems and infrastructural requirements, performance assessments and improvements, deployment opportunities, and integrated systems coupling both renewables and hydrogen production systems.	**15.00-15.30**

Short break **15.30 – 15.40**

Panel Discussion

Moderator: Ibrahim Dincer

	**Chief Lester Anoquot** Chippewas of Saugeen First Nation #29 6 Cameron Dr, Southampton, ON, Canada	
	**Gordon Burton** *Manager,* Hydrogen Technologies Branch Science and Technology, Canadian Nuclear Laboratories (CNL), Canada	
	**Mark Kirby** *President and CEO,* Canadian Hydrogen and Fuel Cell Association (CHFCA), Canada	
	**Xianguo Li** *Professor,* Department of Mechanical and Mechatronics Engineering University of Waterloo, Ontario, Canada	**15.40 – 17.40**
	**Mark Rosen** *Professor,* Mechanical and Manufacturing Engineering, Faculty of Engineering and Applied Science, Ontario Tech University, Ontario, Canada	
	**Robert Stasko** *Principal and CEO,* Science Concepts International (SCI), Canada *Founder,* Zero Carbon Solutions, Canada *Executive Director,* Hydrogen Business Council (HBC), Canada	
	**Andrei V. Tchouvelev** *Founder, President & CEO,* Center for Hydrogen Safety and Codes & Standard, Canada	

Closing Remarks **17.40 – 18.00**