international association for hydrogen energy
Clean and Abundant Energy for Sustainability

Winter 2012 • Volume 4 • Issue 3 *Electronic Newsletter*

General Motors to Move H_2 Fuel Cell Research Facility

General Motors (GM) announced on October 5th that it will be relocating its hydrogen fuel cell research facility. The facility opened in Honeoye Falls, NY in 1999 and is scheduled to move to the powertrain headquarters in Pontiac, MI in the first quarter of 2013. GM spokeswoman Kim Carpenter said it will bring the research closer to work on electric vehicles and other alternative energy technologies. She said it will also allow the group to "capitalize on the technical expertise of not only the fuel cell team, but our other engineering and research groups." The facility's current lease is set to expire and Carpenter said the company will save money by not renewing the lease. GM currently has a demonstration fleet of over 100 fuel cell Chevrolet Equinoxes with over 2 million combined miles, the largest prototype fleet of its kind in the world.


Inside the GM Fuel Cell Facility

For more news coverage about the move, visit these news sites:
http://detroit.cbslocal.com/2012/10/05/gm-moves-important-research-center-to-michigan/
http://www.whec.com/news/stories/s2790586.shtml

Matt Fronk Writes IAHE Commentary

Matt Fronk, who is retired from the position of Director of Fuel Cell R&D at General Motors (GM), wrote the IAHE Commentary for this issue. Matt is currently the President of Matt Fronk and Associates and is a consultant in the alternative energy field. Matt has over 35 years of Industry experience, thirty of that from GM in the areas of Alternative Energy development and Advanced Fuel Cell and Emission Controls. For 20 years, he led GM's PEM Fuel Cell R&D program at both Los Alamos National Laboratory and Honeoye Falls, NY.

Matt's Commentary can be found on *page 2*.

IN THIS ISSUE

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IAHE Commentary

—by Matt Fronk

The Future of PEM Fuel Cells for Automobiles

Over the last 50 years there has been a tremendous amount of work on PEM Fuel Cells to move them from what I consider the "petri dish" to the present where it is just now entering the commercially viable phase. Independent of what you might sometimes hear, the time is now as the Automotive OEMs begin their engineering programs for on-road vehicles to be launched in the 2015-16 time frame globally. They are spending 100s of millions per year to bring this technology forward. In an automobile it solves tailpipe emissions and has no "range anxiety." From a societal perspective it strengthens enlightened countries with respect to energy independence and security.

With that, I think it is important to understand the history of the technology as we look forward to seeing fuel cells in automobiles from these leading OEMs in the next years. This can help shape both our thinking and approaches, as well as focusing the remaining work to be done for everyone from academia, to National labs, to suppliers and OEMs alike.

In the 1960s, General Electric worked on development (Google "GE work on SPE fuel cells") of PEM Fuel Cells that far exceeded life requirements for automobiles (more than 10,000 hrs), but utilized very high Pt loading and required operation on H_2 and O_2. Their application was originally for space ventures, but a vision formed as a path to terrestrial transportation as well. Nafion was invented around this time frame as well (Google "Invention of Nafion"). It is very important to understand that these early developments were being done to show technical viability of the technology. The early requirements drove membrane developments, catalyst developments, and many other material inventions from Gas Diffusion Layers to specific coating for water managements as well as basic system architectures. The folks that worked at this time were true pioneers for us that work in the field today—technical heroes for some of us. They set the vision for what could be. They spent time to understand fundamental operational characteristics as well as failure mechanisms. Much of this work is referenced to this day and is still quite relevant.

But with any technological development comes the harsh reality of becoming a product—moving from research to engineering. I always think of this as a balanced three-legged stool with legs of performance, durability, and cost. Those early fuel cells made electricity and with some very good current/voltage curves (performance), and lasted many thousands of hours (durability), but required H_2 and O_2 to operate and used tremendously high levels of Pt (cost) to function. They certainly looked "technically viable" at the time. A focus was needed on the reduction of Pt loading to levels that could support "commercial viability" (cost). Pt black was the catalyst of choice into the 1980s at these high loadings. A concept to put much smaller particles of Pt on carbon-based supports to reduce the overall amount of Pt and make the Pt being used more effective in the cell was developed. There is a lesson to be learned here in a balanced approach that needs to be used in the future. The lesson is this—we have spent the last 30 years trying to repair fundamental failure mechanisms with Pt on carbon that did not exist with Pt black. While the material costs (Pt) certainly

Continued on page 3

have dropped because of the lower loadings, what if we had taken more of a systems approach to addressing all three legs of the stool? How far would we be today? How close to market ready would we be?

Let's look globally at all the major OEMs that have announced those 2015-16 programs – Daimler, Toyota, Hyundai, Honda, and Nissan, as they have furthered the development of PEM technology through system-level thinking. Let's reflect on the advancements that have occurred over the last 5-10 years in membrane, core/shell type catalysts, metallic bi-polar plates, simplified system architectures, sophisticated control systems for both cold start and a means to address materials degradation as well as more productive ways to make fuel cells and balance of plant components at volumes that would be sustainable in the auto industry. There have been some truly amazing accomplishments with even more on the horizon.

But, we are not done yet. To commercialize fuel cells requires hydrogen infrastructure. This takes real leadership in both the strategic planning and implementation of plans to put this in place. Several countries have really stepped up to embrace the technology and prepare themselves for the future. If we were to only look at the US one would think that not much is happening. The reality is that in Germany, Japan, Korea, and other places—the movement has begun. Plans are being put in place and the governments are working in concert with their auto OEMs to eliminate the "chicken and egg" perspective that many in the US have had about how fuel cell vehicles could be introduced.

So, the message is clear to me. Make sure we focus on the fundamentals and solve problems from a systems-level perspective that encompasses materials, designs, systems & controls, and manufacturability. Make sure we are focused simultaneously on solving those problems from the "three-legged stool" philosophy—performance, durability and cost. Hitting only two of the three is not good enough. It can be done.

I would like to close this by sharing a story with you. A colleague of mine at Los Alamos National Laboratory in the 90s once said to me, "Won't it be great when it happens (FCEVs)." I told him we were not going to wait for it to happen—we were going to make it happen. Well, it is happening and it is happening now. You just have to know where to look. All of you reading this newsletter have a chance to make an impact on the world. Make the most of it as you will only get one shot at it in your lifetime at best, if you are lucky. For all you youngsters still in school reading this, please finish what many of us could only dream about 20 or 30 years ago when we started on this journey. Thank you.

Thank you,

Matt Fronk

Director of Fuel Cell R&D (retired)
General Motors Corporation

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Matt was a founding member and first Chairman of the Board of Directors for NY Best as well as being a contributing member to the NY Climate Action Plan. He has served on the Engineering Advisory Boards for both Penn State and Union College. Matt has a Mechanical Engineering degree from Union College.

News of Interest and Announcements

Hydrogen is Tomorrow's Biofuel

Researchers from the University of Birmingham are creating clean hydrogen from food waste paving the way for a bioenergy alternative for the future.

Currently, Brazil is the world's most intensive user of bioethanol as an alternative to gasoline for powering transport. There are questions about whether the mass production of bioethanol using sugarcane is sustainable in the long-term. Bioethanol generates carbon dioxide and agricultural waste. However, creating clean hydrogen from waste not only uses that waste but provides a fuel that is emission free and can also be sustainably generated .

Presenting his ongoing research at a collaborative bioenergy workshop in São Paulo recently, Professor Lynne Macaskie, Professor of Applied Microbiology at the University of Birmingham, said "Fuel cells need clean energy to run them. If you provide bacteria with a supply of sugary waste from, for example, chocolate production, the bacteria can produce hydrogen. At the moment manufacturers pay to dispose of waste but with our technique they could convert it to clean electricity instead. Bioethanol is the current biofuel of choice in Brazil but our research shows the huge potential for biohydrogen to be the fuel for the future. Biohydrogen could even be made from the wastes from bioethanol production—two biofuels for the price of one. More work from focused teams, however, is needed, as agricultural wastes are tougher for bacteria to digest."

(Source: http://phys.org/news/2012-05-hydrogen-tomorrow-biofuel-scientists.html)

Tests Start for Bio-Hydrogen Production from Sewage Sludge

Four companies that comprise HIT Business Research Group announced the start September 10 of verification tests for a new technology using sewage sludge to produce hydrogen. Their goal is to create a sustainable society based on a low carbon economy.

The companies are: Japan Blue Energy Co.; Daiwa Lease Co.; Toyota Tsusho Corp.; and Mitsui Chemicals, Inc. Daiwa House Industry Co. and Toyota Motor Corp. are participating in the group with observer status.

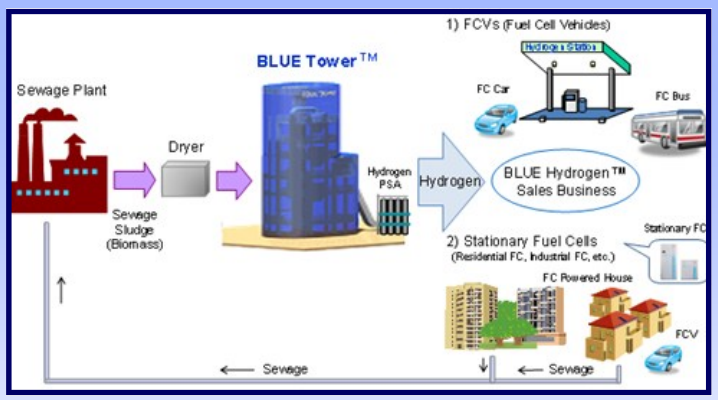
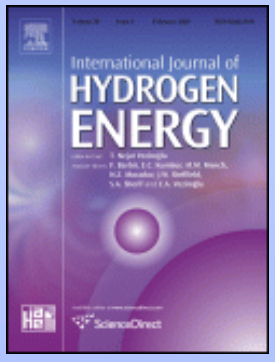


Image Source: Fuel Cell Today

The HIT Business Research Group targets conversion of biomass (disposed sewage sludge) into hydrogen, as a substitute for fossil fuels, utilizing JBEC's proprietary biomass gas BLUE Tower technology. The companies said the introduction of BLUE Tower technology to sewage treatment plants around the country will facilitate supply of hydrogen to fuel cell vehicles and stationary fuel cells.

(Source: www.fuelcelltoday.com)

International Journal of Hydrogen Energy Highlights



The *International Journal of Hydrogen Energy* provides scientists and engineers throughout the world with a central vehicle for the exchange and dissemination of basic ideas in the field of hydrogen energy. The emphasis is placed on original research, both analytical and experimental, which is of permanent interest to engineers and scientists, covering all aspects of hydrogen energy, including production, storage, transmission, utilization, as well as the economical, environmental and international aspects. When outstanding new advances are made, or when new areas have been developed to a definitive stage, special review articles will be considered. As a service to readers, an international bibliography of recent publications in hydrogen energy is published quarterly.

Impact Factor Update for the IJHE

The 2012 Impact Factor (Thomson Reuters) of the IJHE continues its rise, registering at 4.054. The 5 year impact factor, a measure of the longer-term impact of the articles published is even higher, at 4.402. The entire IJHE staff thanks the authors for their excellent contributions, and the reviewers for their tremendous help to continue the tradition of high-quality articles in the IJHE.

Most Highly Cited IJHE Articles (Last 5 Years)

1. **Metal hydride materials for solid hydrogen storage: A review.** Vol. 32, No. 9, pp. 1121-1140, Sakintuna, B., Lamari-Darkrim, F., Hirscher, M. (2007).
2. **A review on reforming bio-ethanol for hydrogen production.** Vol. 32, No. 15, pp. 3238-3247, Ni, M., Leung, D.Y.C., Leung, M.K.H. (2007).
3. **Continuous dark fermentative hydrogen production by mesophilic microflora: Principles and progress.** Vol. 32, No. 2, pp. 172-184, Hawkes, F.R., Hussy, I., Kyazze, G., Dinsdale, R., Hawkes, D.L. (2007).
4. **Biohydrogen as a renewable energy resource-Prospects and potentials.** Vol. 33, No. 1, pp. 258-263, Meher Kotay, S., Das, D. (2008).
5. **Towards the hydrogen economy?** Vol. 32, No. 12, pp. 1625-1637, Marbán, G., Valdés-Solís, T. (2007).
6. **Progress of electrochemical capacitor electrode materials: A review.** Vol. 34, No. 11, pp. 4889 -4899, Zhang, Y., Feng, H., Wu, X., Wang, L., Zhang, A., Xia, T., Dong, H., Li, X., Zhang, L. (2009).
7. **A review of numerical modeling of solid oxide fuel cells.** Vol. 32, No. 7, pp. 761-786, Kakaç, S., Pramuanjaroenkij, A., Zhou, X.Y. (2007).

Top IJHE Downloads (Sept. 2012-Nov. 2012)

1. **Effect of pressure, composition and temperature characteristics on thermal response and overall reaction rates in a metal hydride tank.** Vol. 36, No. 5, pp. 3529-3536, Wijayanta, A.T., Nakaso, K., Aoki, T., Kitazato, Y., Fukai, J. (2011).
2. **Metal hydride materials for solid hydrogen storage: A review.** Vol. 32, No. 9, pp. 1121-1140, Sakintuna, B., Lamari-Darkrim, F., Hirscher, M. (2007).
3. **Simulation on thermoelectric device with hydrogen catalytic combustion.** Vol. 37, No. 1, pp. 884-888, Wang, F., Zhou, J., Wang, G., Zhou, X. (2012).
4. **Production of hydrogen from renewable resources and its effectiveness.** Vol. 37, No. 16, pp. 11563-11578, Bičáková, O., Straka, P. (2012).
5. **Review of the proton exchange membranes for fuel cell applications.** Vol. 35, No. 17, pp. 9349-9384, Peighambardoust, S.J., Rowshanzamir, S., Amjadi, M. (2010).
6. **Progress of electrochemical capacitor electrode materials: A review.** Vol. 34, No. 11, pp. 4889-4899, Zhang, Y., Feng, H., Wu, X., Wang, L., Zhang, A., Xia, T., Dong, H., Li, X., Zhang, L. (2009).
7. **Photo-electrochemical hydrogen generation from water using solar energy. Materials-related aspects.** Vol. 27, No. 10, pp. 991-1022, Bak, T., Nowotny, J., Rekas, M., Sorrell, C.C. (2002).

International Journal of Hydrogen Energy Highlights of Recent Publications

The Effect of Magnetic Force on Hydrogen Production Efficiency in Water Electrolysis

-Lin M-Y, Hourng L-W, Kuo C-W. *International Journal of Hydrogen Energy* 2012; 37(2):1311-1320.

Hydrogen can be produced through several methods; one of the most common is water electrolysis. This publication examined how the magnetism of electrodes used for this process effects production. The direction of magnetism influences several factors such as: the direction of Lorentz force, convection of the electrolytic solution, the direction of bubbles formed, and the efficiency of water electrolysis. It was determined that ferromagnetic electrodes reduce polarization and over potential during electrolysis when compared to paramagnetic electrodes, thus increasing the effectiveness of hydrogen production.

http://www.sciencedirect.com/science/article/pii/S0360319911023500

Fabrication of Hydrogen Electrode Supported Cell for Utilized Regenerative Solid Oxide Fuel Cell Application

-Jung G-B, Chen J-Y, Lin C-Y, Sun S-Y. *International Journal of Hydrogen Energy* 2012; 37(20):15801-15807.

A utilized regenerative solid oxide fuel cell (URSOFC) is a single device that can function as energy storage or a power generation unit depending upon its operation. In energy storage mode the device produces hydrogen and oxygen through water electrolysis. Conversely, the device also acts as a solid oxide fuel cell (SOFC) producing electricity when in power generation mode. The authors report on the anode support cell consisting of commercially available materials. Performance in both modes as a function of operating parameters determined that the URSOFC performance improved with increasing temperature. Fuel cell mode performed better than electrolysis mode due to limited inlet humidity.

http://www.sciencedirect.com/science/article/pii/S0360319912005538

Comparison of Thermochemical, Electrolytic, Photoelectrolytic, and Photochemical Solar-to-Hydrogen Production Technologies

-Wang Z, Roberts RR, Naterer GF, Gabriel KS. *International Journal of Hydrogen Energy* 2012; 37(21):16287-16301.

Solar energy is one of the most sustainable energy sources that can be used for hydrogen production. There are several processes for this conversion from solar-to-hydrogen, some of which include: water splitting, water electrolysis, photoelectrochemical, and photochemical methods. This publication examined the advantages of using solar energy as well as the latest research and development progress of the various technologies. It was concluded that thermochemical cycles are suited for large production needs but are limited by excessive ancillary equipment. Electrolysis and photo-methods are advantageous for hydrogen fueling stations however they have efficiency limitations.

http://www.sciencedirect.com/science/article/pii/S0360319912007033

Continued on page 7

International Journal for Hydrogen Energy Highlights of Recent Publications Cont.

Biohydrogen Production: Current Perspectives and the Way Forward

-Show KY, Lee DJ, Tay JH, Lin CY, Chang JS. *International Journal of Hydrogen Energy* 2012; 37(20):15616-15631.

Biohydrogen has the potential to replace current hydrogen production technologies relying heavily on fossil fuels through electricity generation. Global research is moving forward in developing biological production of hydrogen as a renewable energy source to alleviate stresses due to carbon dioxide emissions and depleting fossil fuels resource. While biohydrogen research is still immature, extensive work on laboratory- and pilot-scale systems with promising prospects has been reported. In this paper, a review of advances in biohydrogen production focusing on production pathways, microbiology, as well as bioreactor configuration and operation has been provided. Challenges and prospects of biohydrogen production are also outlined.

http://www.sciencedirect.com/science/article/pii/S0360319912010026

Microbial Hydrogen Production by Bioconversion of Crude Glycerol: A Review:

-Sarma SJ, Brar SK, Sydney EB, Le Bihan Y, Buelna G, Soccol CR. *International Journal of Hydrogen Energy* 2012; 37(8):6473-6490.

Bioconversion of different organic waste materials to hydrogen is a sustainable technology for hydrogen production. Crude glycerol generated during biodiesel manufacturing process can also be used as a feedstock for hydrogen production using microbial processes. The possibility of using crude glycerol as a feedstock for biohydrogen production has been reviewed in this article. A review of recent global biodiesel and crude glycerol production and their future market potential has also been carried out. Similarly, different technical constraints of crude glycerol bioconversion have been elaborately discussed and some strategies for improved hydrogen yield have also been proposed. Strategies for application of co-culture of suitable microorganisms as inoculum for crude glycerol bioconversion and improved hydrogen production have also been proposed.

http://www.sciencedirect.com/science/article/pii/S0360319912001000

Call For New Student Chapters

The IAHE is continuing its call for the development of student chapters all over the world. To begin a chapter at your school a faculty leader and interested students are needed. In total, over 26 student chapters in 9 countries are officially recognized by the IAHE. The activities for the chapter members can include participation in the hydrogen design competition, research seminars for graduate students, job fairs, social activities, and various other related activities chosen by the students. To become a student member (registration is free), please register online at:

http://www.iahe.org/Studentmembership.asp

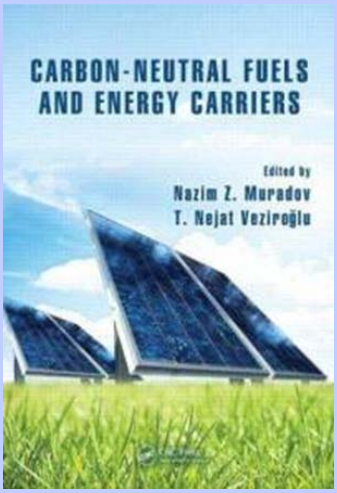
IAHE Affiliates:

The IAHE has organizational affiliate organizations worldwide. To see a complete listing, please go to: www.iahe.org
The IAHE also seeks to further develop and promote hydrogen-based organizations worldwide. For more information on collaboration opportunities, please contact Matthew Mench at mmench@utk.edu.

From the Bookshelf

Carbon-Neutral Fuels and Energy Carriers

-Edited by Nazim Z. Muradov, T. Nejat Veziroglu



Carbon-Neutral Fuels and Energy Carriers emphasizes the vital role of carbon-neutral energy sources, transportation fuels, and associated technologies for establishing a sustainable energy future. Each chapter of this book draws on the insight of world-renowned experts in such diverse fields as photochemistry and electrochemistry, solar and nuclear energy, biofuels and synthetic fuels, carbon sequestration, and alternative fuel vehicles.

Features:

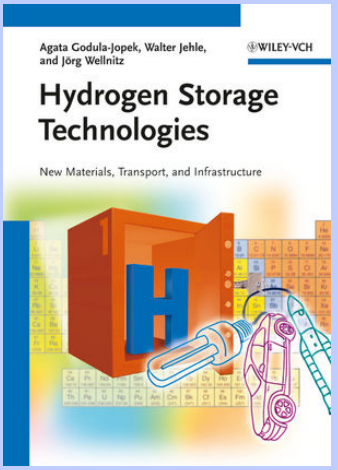
- Presents a comprehensive account of carbon-neutral energy sources and fuels that will become increasingly important in the future
- Covers renewable, nuclear, and decarbonized fossil energy; hydrogen fuel, biofuels, and synthetic fuels; and photochemical, thermochemical, electrochemical, and biological systems
- Analyzes the technical, economic, and environmental challenges hindering widespread commercial adoption of carbon-neutral technologies
- Provides examples of the first successful commercial-scale projects

In summary, the book provides the information needed to make more informed choices regarding available clean energy and fuel alternatives. It helps readers to better understand the interconnection between energy and the environment as well as the potential impact of human activities on climate.

http://www.crcpress.com/product/isbn/9781439818572

Hydrogen Storage Technologies

-By A. Godula-Jopek, W. Jehle, and J. Wellnit



Hydrogen storage is a critical area of development required for the hydrogen economy. The authors explore this topic with respect to environmental, economic, and safety considerations. Infrastructure requirements are also addressed for hydrogen in production, transportation, military, stationary and mobile applications. Current and future storage technologies are included, as viewed from an industrial perspective. Emphasis of the text is placed on prominent mechanisms with potential for commercial implementation.

http://www.wiley.com/WileyCDA/WileyTitle/productCd-3527649948.html

Upcoming Meetings, Activities, and Workshops

December 2012

4th International Renewable Energy Congress (IREC)
December 20-22, 2012
Sousse, Tunisia
http://www.irec.cmerp.net/

January 2013

World Future Energy Summit & Exhibition
January 15-17, 2013
Abu Dhabi, United Arab Emirates
http://www.worldfutureenergysummit.com/

February 2013

FC EXPO 2013: 9th International Hydrogen and Fuel Cell Expo
February 27-March 1, 2013
Tokyo, Japan
http://www.fcexpo.jp/en/

March 2013

The 30th International Battery Seminar & Exhibit
March 11-14, 2013
Fort Lauderdale, Florida, USA
https://powersources.net/florida/frameset.html

April 2013

H2FC-FAIR 2013: Europe's largest hydrogen and fuel cells exhibition
April 8-12, 2013
Hanover, Germany
http://www.h2fc-fair.com/

BIT's 3rd Annual World Congress of Bioenergy (WCBE-2013)
April 25-27, 2013
Nanjing, China
http://www.bitlifesciences.com/wcbe2013

May 2013

223rd Meeting of ECS — The Electrochemical Society
May 12-17, 2013
Toronto, Ontario, Canada
http://www.electrochem.org/meetings/biannual/223/223.htm

July 2013

The Sixth International Exergy, Energy and Environment Symposium (IEEES-6)
July 1-4, 2013
Rize, Turkey
http://ieees6.rize.edu.tr

September 2013

ICHS 2013: 5th International conference on hydrogen safety
September 9 - 11, 2013
Brussels, Belgium
http://www.ichs2013.com/

WHTC 2013: The 5th World Hydrogen Technologies Convention
September 25-28, 2013
Shanghai, China
http://www.whtc2013.com/

November 2013

EVS27: The 27th World Electric Vehicle Symposium & Exhibition
November 17-20, 2013
Barcelona, Spain
http://www.evs27.org

Do you have a hydrogen-related meeting, workshop, or activity you would like us to include in the next issue of the IAHE Newsletter? If so, please email a description and web link to Matthew Mench at mmench@utk.edu.

Get Connected - Internet Groups of Interest

LinkedIn e-Connections

Fuel Cell & Hydrogen Network

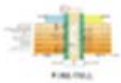
Bringing together professionals and enthusiasts alike, the Fuel Cell & Hydrogen Network serves to connect those advocating fuel cell and hydrogen technologies. The group welcomes people who are interested in all types of fuel cell technologies as well as the wide variety of hydrogen technologies, and is not exclusive of hydrogen fuel cells.

Fuel Cells

Welcomes those who are interested in clean energy fuel cell applications and technologies. Encourages members to start discussions that are relevant to fuel cells, to post promotions and jobs, and to use this group to develop their professional network.

Fuel Cell Technology

All those engaged in teaching, research, manufacturing and application of fuel cells are welcome to join the group.



Fuel Cells: Investment, Funding and Commercialization

The group is to discuss the path of fuel cell technology towards commercialization. While technology will be discussed, there is a special focus on private investment, government funding and updates in international policy as relating to fuel cells.

Fuel Cell Energy

The Fuel Cell Energy Group advocates the use of Fuel Cell Energy & the promotion of its Technology and for those interested in learning more about Fuel Cell Technology. Fuel Cell Professionals, Renewable Energy, Clean Technology, and Environmental Advocates are welcome. Solar, Wind, Biomass, Biofuel, Tidal Power & Wave Professionals also welcome to learn about this emerging technology.

HTPEM fuel cells

For Engineers, business people, scientists, journalists, authorities, investors etc. who are interested in HTPEM. Reports, discussions, analyses and networking events within the HTPEM fuel cell part of the fuel cell industry will be posted and shared.

Hydrogen Fuel Cell (Micro-CHP)

This group is intended to educate and share knowledge associated with micro-CHP systems that generate distributed energy—heat and/or electricity. This group is intended to cover residential, commercial, and public applications.

Get Connected Cont.

Facebook e-connections

Horizon Fuel Cell Technologies

Horizon Fuel Cell Technologies was founded in Singapore in 2003 and currently owns 5 international subsidiaries, including a new subsidiary in the United States. Having started commercialization with small and simple products while preparing for larger and more complex applications, Horizon already emerged as the world's largest volume producer of commercial micro-fuel cell products, serving customers in over 65 countries. In 2009, the team also began Horizon Energy Systems, a separate company in Singapore which applies its ultra-light fuel cell technologies for customers in Aerospace & Defense

Horizon's complete technology platform is comprised of three main parts: fuel cells and their materials, hydrogen supply and hydrogen storage. This platform enables a variety of product developments targeting commercial markets, both as Horizon products, as well as third party branded products.

Today, Horizon is able to produce extremely compact, lightweight, PEM fuel cells at varying degrees of complexity and performance, as well as deliver hydrogen storage and on-site hydrogen generation solutions that are suitable for many specialty and mainstream applications, including consumer electronics, portable power, educational solutions, stationary power, ultra-light systems for military use, as well as electric mobility solutions.

Fuel Cell and Hydrogen Energy Association

The trade association for the fuel cell and hydrogen energy industry. Dedicated to the commercialization of fuel cells and hydrogen energy technologies. Fuel cells and hydrogen energy technologies deliver clean, reliable power to leading-edge corporate, academic and public sector users, and FCHEA members are helping to transform our energy, economic, and environmental future.

Fuel Cell Nation

Fact-Based Analysis and Discussion of Clean Energy
http://blog.fuelcellnation.com/

The International Association for Hydrogen Energy is Now on Facebook!

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Photo Gallery

Photos from the Electrochemical Energy Storage Conversion Forum held in Knoxville, Spring 2012

Send us a photo. If you would like a photo of your student chapter or IAHE related event included in an upcoming issue of the IAHE newsletter, email the photo to Matthew Mench at mmench@utk.edu.

Newsletter Production

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If you have any questions about the newsletter, email Matthew Mench at mmench@utk.edu.

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IAHE Objective

The **objective** of the IAHE is to advance the day when hydrogen energy will become the principal means by which the world will achieve its long-sought goal of abundant clean energy for mankind. Toward this end, the IAHE stimulates the exchange of information in the hydrogen energy field through its publications and sponsorship of international workshops, short courses, symposia, and conferences. In addition, the IAHE endeavors to inform the general public of the important role of hydrogen energy in the planning of an inexhaustible and clean energy system.

Contacts and Information

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On the Web

International Association for Hydrogen Energy (IAHE)
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International Journal of Hydrogen Energy (IJHE)
The Official Journal of the IAHE
http://www.elsevier.com/locate/he