An Alternative Energy News Source Interview with Jennifer Gangi, the Program Director of Fuel Cells 2000

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Jennifer Gangi is the Program Director of Fuel Cells 2000, an educational resource for hydrogen fuel cell commercialization. We spoke to her about how soon fuel cell cars will hit the market, how fuel cells work, the economics and technology of making hydrogen fuel, and the meaning of the phrase "the hydrogen economy."

Altenews: Your purpose is to help hydrogen fuel cell commercialization. How did you arrive at this type of job?

Jennifer: I actually answered an ad for a writer – the ad was very vague, just said that a writer was wanted to write about technology. I have an English background but had been working for a few years at a PR firm that handled only high-tech clients – computer graphics, animation, that sort of thing. I have been here for almost 7 years and have been the Program Director of the Fuel Cells 2000 program for the last 4. It is really rewarding working to promote something that can truly change the world both environmentally and economically. Everyone involved in this industry really believes in the potential of fuel cells and hydrogen, and that is inspiring.

How did Fuel Cells 2000 get started, and what are your major accomplishments?

Fuel Cells 2000 began in 1998, as a program of Breakthrough Technologies Institute, a non-profit in Washington, DC. Our website, www.fuelcells.org has won several awards and accolades from : *Awesome Library* (www.awesomelibrary.org), a collection of the top 5% sites in the field of K-12 education; The National Science Teachers Association (NSTA, www.scilinks.org), *sci*LINKS®; and *Popular Science* magazine, as one of the “50 Best of the Web” Sci-Tech Sites in October 2000.

I think our major accomplishment is lasting as long as we have while not compromising on quality/service – we are the leading non-aligned source for fuel cell information and offer a lot of things for free that companies/organizations try and sell. For a small non-profit, we have some tremendous resources on our website – the Fuel Cell Match Maker Message Board (job/resume postings), Fuel Cell Career and Education Center, searchable databases, interactive maps, presentations, reports, images, links to other resources, product and comparison charts, you name it.

How long will it be until research and development creates hydrogen-powered cars for use by the general public?

The technology is here – it works. My coworkers and I saw the Honda FCX driving down G Street in Washington, DC on our way to lunch the other day. The challenges now are lowering the cost and increasing the driving range of the vehicles – people don’t want to sacrifice what they are used to. Most automakers are saying somewhere between 2010-2015. I think a lot of education has to be done while the research/development is taking place to help reach that goal.

Where is the best hydrogen research being done right now?

A lot of innovative research is being done at the university level. There are numerous colleges and universities with fuel cell and hydrogen programs and research centers working with both industry and government to move the technology forward.

What are the best products available right now that involve fuel cells?

There are a lot of educational kits and some backup units available now. www.fuelcellstore.com is a great site to see what is out there for purchase.

What hydrogen fuel cell companies do you think show the most promise?

There has been a lot of activity in the fuel cell and hydrogen arena as of late – lots of research, demonstration, sales and advancements from both larger fuel cell developers and smaller start-up companies – I would be hard pressed to pick just a few. Right now, I am excited to see a lot of well-established and well-known companies getting involved in the demonstration of fuel cells – UPS, FedEx, Wal-Mart, Verizon, Sheraton, etc. This really helps with both the research/development side of fuel cells but also with education, which is a big obstacle. When people read about a company that they have heard of, or in small towns, know someone who either works there or they drive by it every day - that really helps break down some of the educational barriers. When my friends from home or my mom flag articles on fuel cells and actually know what they are reading, I know things are changing.

How does a hydrogen fuel cell work?

A fuel cell is an electrochemical device that takes advantage of the natural attraction that hydrogen has for oxygen. In structure, a fuel cell is much like a battery: it has two electrodes separated by an electrolyte. But in use it is very different from a battery. A fuel cell will not "run down" and never needs recharging. A fuel cell will provide useful electricity and heat as long as hydrogen fuel is supplied.

In a PEM fuel cell, hydrogen is fed to one electrode, and oxygen, or air, is fed to the other. Encouraged by a catalyst, both the hydrogen and oxygen give up their electrons (they become ions). The hydrogen passes through the electrolyte to the oxygen side. But the electrons cannot pass through and must take a path around the electrolyte. In the process, they can be harnessed for useful work. Finally, the electrons, hydrogen and oxygen all reunite to form water.

Is there enough government funding of hydrogen research?

Well, I would say that although we are happy that the government is funding hydrogen and fuel cell research, that no, there isn't enough. I would love to see the government step up and become more active in actually purchasing fuel cells – placing an order for vehicles for government fleets, installing back up units at government facilities, etc. DoD had a few successful programs for funding and installing stationary fuel cells at military bases and other location sites around the country. Those programs provided crucial data on fuel cell operations, maintenance and siting. Hydrogen and fuel cells offer a lot of potential to reduce emissions and our dependence on foreign oil, create jobs and put the U.S. at the forefront of the industry and can help bolster energy security and our energy infrastructure. No more blackouts, brownouts or electricity outages – I think the government should be installing them in areas prone to hurricanes and blackouts.

At the state level, a lot of states are stepping up to the plate and offering tax incentives, rebates, funding for research, etc. We just compiled a state-by-state analysis of hydrogen and fuel cell activity and 47 states and the District of Columbia have some sort of program, demonstration or legislation promoting fuel cells and hydrogen. There are several states vying to be the leader in the United States, even the world, with regards to fuel cells and hydrogen. In some instances, states are offering more funding than the federal government.

What are the best commercial uses for a hydrogen fuel cell? Are there other uses besides transportation?

There are many great commercial applications for fuel cells besides passenger vehicles. In the transportation arena, fuel cells are being demonstrated in forklifts and scooters, both proving to be cost-effective and providing numerous benefits over conventional power sources. Fuel cell APUs (auxiliary power units) can drastically reduce emissions for tractor-trailer trucks that idle on the roadside for hours at a time.

Backup power is also a great application for fuel cells – for telecommunications, radio and 911 towers – they are durable, reliable and last longer than batteries. Fuel cell generators offer a quiet and clean alternative to loud and smoky diesel generators for camping and other backup power uses.

What technology is being developed to make hydrogen storage safe so that fuel cells can become widely used?

The issue with hydrogen storage isn't safety, it is storing enough hydrogen to provide a 300-mile (or more) range per tank. That is one of the main barriers to overcome before the fuel cell vehicles can become commercialized. There have been numerous tests to prove that hydrogen is as safe, if not safer than other fuels.

In order to be effective, fuel cells need a steady supply of hydrogen at a competitive price. Where do you think that hydrogen fuel is going to come from?

That is hard to say – in the short term, most likely from reforming of natural gas. The great thing about hydrogen is that it can come from a wide array of feedstocks. In Japan, many hydrogen stations have been installed and opened, all generating hydrogen from a different source. This is a good way to see which feedstocks are more efficient, cleaner, cheaper. etc. Solar and wind powered electrolysis of water and nuclear are all possibilities as well.

A great source of hydrogen is methane or anaerobic digester gas – many landfills, wastewater treatment plants, breweries and farms are using the waste products of their respective industry to serve as a source for hydrogen to power a fuel cell. This is a highly efficient and clean approach – capturing the waste and using it for power. With fuel cells, you can also capture the excess heat and use it for space heating or for hot water.

How much electricity is required to make enough hydrogen to be the equivalent of a typical full tank of gas?

A very rough figure would be about 60 kWh per gallon, so 15 gallons (typical tank) = 900 kWh. Remember that a fuel cell is 2-3 times more efficient than an internal combustion engine, so even though it takes energy to make hydrogen, you are getting more energy out of the fuel you use. Well-to-Wheel analyses compare the entire pathway of producing, storing, distributing and utilizing fuel. They can compare efficiencies and energy needs for the many different hydrogen production methods as compared to different fuels and vehicle technologies. Well-to-Wheel studies have found that most, but not all, of the fuel cell vehicle/fuel combinations being considered achieve significant energy and greenhouse gas (GHG) emission benefits over existing and other advanced technologies. The best performing fuel cell vehicles and fuel combinations do far better than the alternatives. *Fuel Choices for Fuel-Cell Vehicles: Well-to-Wheels Energy and Emission Impacts* by Michael Wang combines and analyzes all of the Well-to-Wheels studies. http://www.transportation.anl.gov/pdfs/TA/260.pdf

Some hydrogen advocates say that hydrogen fuel should be made from nuclear power, while others say it should be made from renewable energy, and some say wind power. Which do you think would be best?

I am interested in learning more about the possibilities of nuclear power but don't know too much about the specifics or potential drawbacks (waste?) just yet. Generating hydrogen from renewable sources would be ideal, but in the short term, may not be the most cost effective way to get the technology out there. I would hope that eventually we can achieve that, though.

There are several biological species, including termites and various kinds of bacteria, that naturally produce hydrogen. Do you think biological production of hydrogen will be a major contributor to fuel supply?

I am not sure it will be a major contributor, but it is an innovative and natural way to produce hydrogen. There is a lot of really cool research in this area right now.

What does the phrase "the hydrogen economy" mean? When and where might "the hydrogen economy" happen?

To me, the phrase 'hydrogen economy' means we are generating power domestically, reducing our dependence on foreign oil and weaning ourselves off of petroleum-based fuels. Hydrogen has a lot of potential to fuel our cars, buses, buildings, electronic appliances and anything else that uses power – the best part is that it can be done with low-zero emissions, reliability, and scalability, all while increasing energy security and jobs.

The hydrogen economy is already starting to happen in Iceland. Canada is striding ahead with hydrogen research and development. Countries in Asia are working hard on fuel cells for both stationary and transportation applications. Here in the U.S., 14 states have developed a hydrogen roadmap, with 3 more developing them. California has taken the lead, but many states are following suit. The hydrogen economy is definitely possible and offers a very bright future for the word.