

**Prince Edward Island
Wind~
Hydrogen
Symposium
June 23 & 24 2003**



LEADERSHIP



Premier Pat Binns

Prince Edward Island has an excellent wind regime, one of the strongest in Canada. That is why we are home to Canada's only wind test site, the Atlantic Wind Test Site, and why we developed the North Cape Wind Farm. While it must be developed wisely, and at the right pace to support continuing access to existing energy supplies, the wind resource will be developed to its full potential.

I suggested that we hold the PEI Wind-Hydrogen Symposium because it appears that, in time, hydrogen may allow us not only to increase the percentage of our electricity generated by wind, but to reduce our dependency upon petroleum products. By taking a leadership position in hydrogen, we may also develop or model hydrogen technologies that companies located here can export to islands and other jurisdictions around the world.

I would like to express my appreciation to those who attended the conference for contributing their expertise, vision and enthusiasm. In the coming months we hope to demonstrate that this was time well spent.

Development and Technology Minister, Michael Currie

I express my sincere thanks to the participants in the PEI Wind-Hydrogen Symposium in helping us to identify possible made-in-PEI solutions for hydrogen issues.

Prince Edward Island provides a unique opportunity to research, develop and demonstrate hydrogen technologies. To companies interested in pursuing this opportunity we offer clean energy, a low cost base and a strong commitment to partner to develop opportunities and solutions. We have the wind resource and we have the will. To discuss this opportunity further, please call me at 902-368-4230.



The Prince Edward Island Energy Corporation is a PEI Crown Corporation which reports to the Minister of Development and Technology. The Corporation oversees the Atlantic Wind Test Site in partnership with Natural Resources Canada, owns and operates the North Cape Wind Farm, as well oversees energy development in PEI.

CONTEXT

Prince Edward Island is unique in the Canadian confederation. Its size and population are small, but the population is distributed more evenly than in larger provinces. As the Symposium Moderator, UPEI President Dr. Wade MacLauchlan rightly said, “*This is a place you can get your arms around.*” Our communities are often separated by much less distance than visitors from elsewhere in Canada are accustomed to. And, unlike other provinces, PEI is neither vast nor rugged, but has a gently rolling, pastoral beauty. It is, of course, an Island, ringed with sandy beaches and cool ocean water.

Prince Edward Island is not blessed with substantial traditional energy resources. Natural gas has yet to be discovered in commercial quantities; there is minimal potential for oil, hydro-electric or nuclear power. Solar power holds potential, but perhaps less than in more southern climates, and the tidal power opportunity may be developing, but technologies do not yet indicate a strong opportunity. What Prince Edward Island has, however, is an excellent wind regime.

On June 23 and 24 2003, approximately 50 people met in Charlottetown to discuss the approach through which Prince Edward Island could best participate in the evolution of hydrogen technologies and the use of hydrogen as an energy carrier. The group included business leaders from the wind and hydrogen industries, including people from companies across Canada, members of Atlantic Canada’s university community, government representatives from the Province of PEI, Natural Resources Canada, Industry Canada, the Atlantic Canada Opportunities Agency, the Provincial and some municipal governments and interested observers.

The group was asked to respond to four questions:

What is the optimum long term vision for the use of hydrogen of Prince Edward Island?

What should Prince Edward Island be doing in the short and medium terms to most quickly advance us towards that long term vision? In other words, what R & D and demonstration initiatives can be implemented on PEI in the short and medium terms?

What are the things that we need to know, but don’t know, that can be most suitably learned on Prince Edward Island with regards to wind-hydrogen potential?

How can Prince Edward Island best model unique characteristics of hydrogen development that can be subsequently exported to the world?

This summary document is intended to capture the essence of those discussions. For copies or to comment, please contact the PEI Energy Corporation, PO Box 2000, Charlottetown, PEI, C1A 7N8 or contact jdlarter@gov.pe.ca.

VISION



Abundant, affordable, pollution-free energy produced locally on Prince Edward Island to meet all of our energy needs; this is a dream - but a dream made more possible by recent developments in hydrogen technologies. Now we can say: “One day, perhaps”.

Symposium participants identified obstacles as well as opportunities. For example, wind will not be available to produce hydrogen in substantial quantities until there is surplus of electricity from wind, which is not currently planned. Alternative renewable energy sources may also contribute to electricity and hydrogen generation. Water recycling will be extremely important. The hurdles to be overcome are vast. Nonetheless, technology currently available proves the concept’s potential, and the drivers for change - climate change, energy insecurity, air quality - suggest that a real opportunity is developing.

One participant summarized a common theme in saying, “I envision Prince Edward Island as an island model for energy self-sufficiency”. Other comments included, “PEI can show how to overcome the energy crunch for any island or isolated community, and offer this expertise to others.,” and, “PEI can convert its expertise for wind-diesel applications to wind-hydrogen and increase the value proposition.”

Attendees envisioned the development of a network of hydrogen installations across Prince Edward Island, including farms, golf courses, fishing fleets and office buildings. Wind turbines might or might not be located near each installation. It was judged more likely that electrolysis would occur on site; in other words, that the distributed model of hydrogen production was a good model for PEI.

The chicken and the egg!

A recipe emerged to resolve the chicken-and-egg problem of developing a vehicle fueling network (cars first or commercial fueling stations first). Take an Island of small or moderate size; develop a network of private hydrogen installations; encourage installation owners to offer hydrogen for sale to others; promote these locations. When this is done, H2 vehicles will be viable without the presence of commercial fueling stations, although commercial stations will no doubt follow when enough vehicles are in place.

There may be an advantage in thinking small. The human-scale of PEI encourages consideration of small-user applications. By thinking small-scale, Prince Edward Island may identify opportunities to market services, applications and expertise around the world. The President of the University of Prince Edward Island, Wade MacLauchlan, mentioned that UPEI is a community of 4,000 people, and that this might be a suitable project size to market around the world. The potential to increase tourist interest was not overlooked.

Most importantly, the consensus at the conference was that the greatest potential export is knowledge. Growing local expertise through practical application may be our most important goal.

OPPORTUNITY

Imagine an energy self-sufficient community powered by electricity from wind: the fossil-fuel-free community: no gasoline, no heating oil, just electricity generated from wind used directly as electricity or through a hydrogen storage and conversion system. Residents would demonstrate the hydrogen economy in their daily lives, long before the rest of the world.

This suggestion, which arose from the Wind-Hydrogen Symposium, captures the imagination. It may also capture a timely opportunity for the participating community. The community which undertakes to become the world's first self-sufficient wind-hydrogen community may access funds for research and development, would generate economic development, and use its uniqueness as a tourism draw.

Such a project would be rolled out over a number of years. Here is how it can be done.

- ◆ Provide sufficient wind energy to meet all of the community's electricity needs. This can be done by installing or connecting to existing wind turbines of sufficient capacity.
- ◆ Add sufficient wind capacity to provide electricity for one or two hydrogen conversion and storage stations.
- ◆ Install hydrogen capability to provide electricity when the wind is insufficient. Perhaps start with the community hall, the industrial park or the police detachment.
- ◆ Encourage the conversion of community or police vehicles to hydrogen fuel cells or internal combustion engines (ICE) and provide fuel from the HES installation.
- ◆ If a port community, provide hydrogen power for a small local fishing fleet and encourage fishers to convert trucks for hydrogen ICE.
- ◆ Maintain a strong relationship with the research community to ensure technological advancement; role out additional improvements over time. Ensure that developments are well monitored.
- ◆ Encourage the participation of citizens and local industry.
- ◆ Practice world-class energy efficiency.
- ◆ Promote accomplishments.

The process would take years, of course, although the presence of an active wind farm means that the first requirement is in place. Some steps may come quickly; others, such as the transition to hydrogen fuel for boats, trucks and cars, will come more slowly. However, even during development the community will model something that, to the rest of the world, remains a dream.

ACTIONS

Consideration was given to the actions that would be most suitable for the development of hydrogen on Prince Edward Island. These included pilot projects and other initiatives such as the establishment of a Hydrogen Centre of Expertise.

Centre of Expertise:

To encourage rational, planned development of hydrogen research and demonstrate the establishment of a Hydrogen Centre of Expertise was proposed. The Centre would coordinate activities, liaise with governments and interested parties, participate in the development of standards and work to promote public awareness. One attendee suggested that PEI “set up an extensive information distribution system for hydrogen.”

The Centre of Expertise would be the organizing body to ensure that deployment developed into expertise and that research and opportunities were captured and, where appropriate, commercialized.

Community Pilot:

The suggestion was made to provide the energy for a single demonstration community through a combination of electricity from wind and hydrogen. It would be accomplished by providing a community with sufficient electricity from wind to meet all electrical requirements and an increasing share of energy needs currently supplied through petroleum. When the electricity supply was in place, one or two hydrogen installations would provide heat and transportation fuels.

The project would be scalable, the information learned invaluable and transferable. It would provide a model of the hydrogen economy, allowing study of all related issues, technical, logistical and sociological.

The project would work well in combination with one of the other projects identified, such as the fishing fleet. This project is summarized in more detail earlier in this document under the title “Opportunity”.

Fishing Boat Pilot:

An interesting proposal from the group was to consider piloting hydrogen from wind power as a fuel for a small fishing fleet. Fishing fleets are located on the water, therefore, some fleets will certainly be located in areas of effective wind regimes. It was also noted that hydrogen storage system would provide excellent ballast for the boats. The fueling station would be located on the wharf, thus providing the option of fueling vehicles.

Research would focus on the use of wind-hydrogen energy in a small, commercial fishing fleet. The project has the potential to represent a centralized model, with the hydrogen produced near to the source wind turbine.

Farm Pilot:

Begin by providing a farm with wind energy, either by constructing/permitting a wind turbine at the farm or wheeling power from a wind farm (or test site) turbine to that site. Install a hydrogen energy station at the farm to provide electricity, heat and transportation fuels for the fleet. If possible, select a farm that already uses renewable energy, such as solar energy, and research the potential to add to the hydrogen capacity through production of hydrogen from other sources, such as biomass.

The project has the potential to develop an end-to-end solution for an individual or community application, as well as to integrate other renewable energy sources. The model could be expanded for farm clusters and communities.

Golf Course Pilot:

Another proposal was to establish an environmentally friendly golf course in which wind energy and hydrogen would be used to power an entire golf course: electricity, golf carts, tractors and other equipment. The potential for increased tourist interest was mentioned.

This controlled environment would provide an excellent study opportunity for a stand-alone hydrogen deployment. If the course is located near the shore, the wind turbine could be located near at hand. As the golf course would largely be a summer operation the potential for production of hydrogen and electricity in summer would be tested.

RESEARCH

Prince Edward Island is an ideal location to perform wind-hydrogen research or establish demonstration projects. Many factors suggest this: the small geographic area with relatively consistent population density; the seasonal and changeable climate; the strong ocean winds; the popular interest in alternative energy solutions; the active and growing North Cape Wind Farm. The Island is home to the Atlantic Wind Test Site, with over twenty years experience in wind energy research, and the University of Prince Edward Island. UPEI featured a sizeable contingent at the Wind-Hydrogen Symposium, including the assistance of President Wade MacLauchlan as Moderator.

1. Project or Pilot Issues

- * Develop wind-hydrogen applications which are simple to install and use and therefore easily transferrable.
- * Explore all the issues relating to provision of all energy to a single community using wind energy and hydrogen.
- * Develop solutions for fishing fleets considering the potential for using hydrogen storage for ballast.
- * Consider an integrated energy system for a farm application involving multiple energy sources.
- * Establish the world's first golf course fully powered by wind energy and hydrogen.

2. Energy Economies

- * What amount of hydrogen could be created from wind power on PEI?
- * At what point is a hydrogen buffer needed to meet the peak load? What is the cost shift? Does hydrogen make sense as just a method of peak shaving?
- * Compare the efficiencies and relate economies of grid supplied hydrogen versus tanked hydrogen

3. Practical Issues

- * Develop wind-hydrogen control systems for multiple applications.
- * Network diverse hydrogen applications and approaches into a broad network.
- * Conduct a feasibility study of a 100 kw wind hydrogen system
- * Identify safety mitigation issues/Safety demonstration
- * Develop improved hydrogen storage techniques

4. Wind Mapping

- * Complete a wind map of Prince Edward Island and, if possible, Canada, to identify the best siting locations for wind farms and to identify special implications for such sites (such as ice, population density and bird migration). It was mentioned in the Symposium that one US state offers information on wind potential on-line for free.

SUMMARY

The Prince Edward Island Wind-Hydrogen Symposium was organized to develop a vision for the application of hydrogen in this small and unique Canadian province. Participants were asked what PEI could do in the long and short terms as well as what research and demonstration projects could be undertaken to advance the understanding and implementation of hydrogen technologies. The Symposium was also intended to establish a network of interested individuals and companies to support these goals.

Although asked to develop long and short term visions separately, participants tended to run these together, as if more comfortable envisioning the evolution of the hydrogen opportunity rather than a speculative final state. A multi-stage process emerged from discussions: initial pilots, followed by the clustering of initiatives, which would lead to the presence of a functional network.

Deployment included the establishment of a Centre of Expertise to guide hydrogen developments in PEI and Atlantic Canada. One pilot project that was identified was to operate the appliances, heating systems and equipment of a farm using wind and hydrogen (possibly biomass and solar energy as well). Another pilot project suggested the operation of a small fishing fleet; another suggestion was to develop an energy self-sufficient golf course with its own wind turbine and hydrogen energy station. A final suggestion was to provide energy for a small community, although this project might be combined with another, such as the fueling of a fishing fleet.

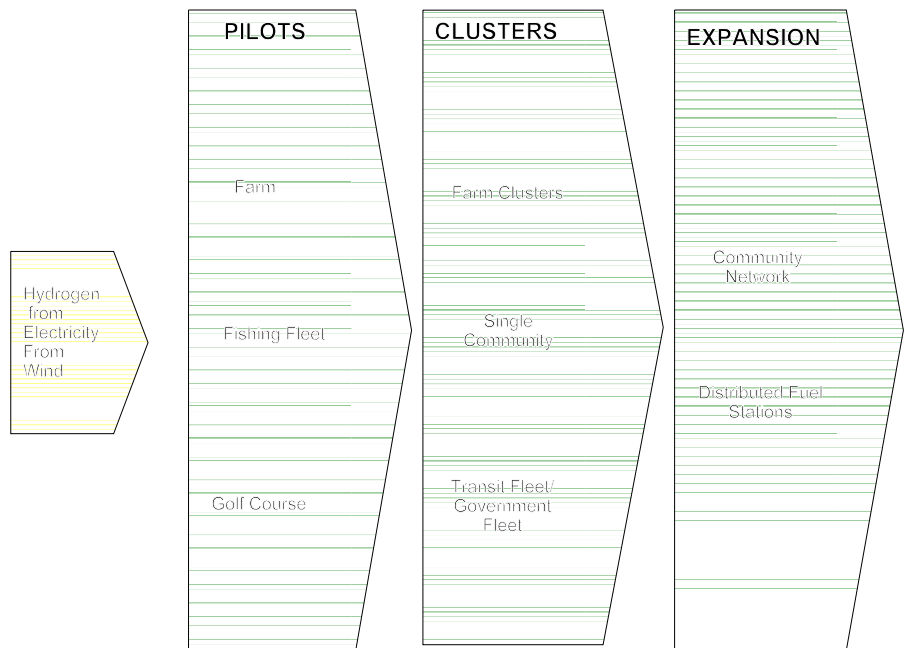


Figure: Evolution of Hydrogen Development on PEI

The establishment of multiple projects will result in the development of an informal network. This informal network could provide hydrogen fuel stations for vehicles across the Island, and so overcome the problem of how to justify hydrogen cars without a fuel source, or a fuel distribution system without cars.

The work now begins: to develop these suggestions into concrete proposals, to identify partners and funding, to see the installations and organizations in place. When this stage is underway, the significant work will begin, developing expertise in Atlantic Canada to make a valuable contribution to global advancement in hydrogen technologies.