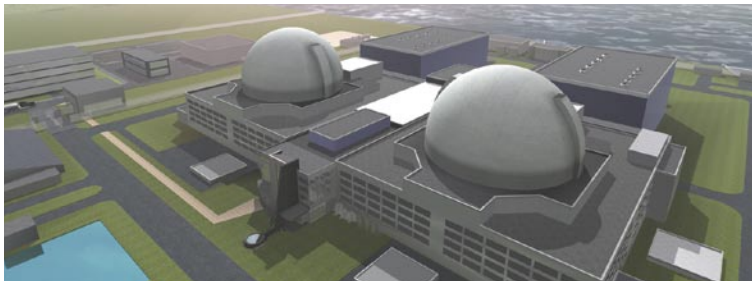
AECL

Clean hydrogen from CANDU® nuclear power

Why nuclear energy to produce hydrogen?

Hydrogen is not a primary energy resource and must be generated from other forms. One method of producing hydrogen is to extract it from water through electrolysis—using nuclear energy to separate water molecules into their constituent hydrogen and oxygen. Using nuclear energy to produce green hydrogen as a fuel is also the most environmentally beneficial method.

- The use of hydrogen in the production of transport fuels from crude oil is increasing rapidly
- Hydrogen is likely to be an important future fuel for CO_2 emission reduction for transport
- Nuclear energy can be used to make hydrogen through electrolysis without creating CO_2 emissions
- Energy demand for hydrogen production could ultimately exceed that for electricity production today
- Pluggable hybrid vehicles have potential to increase the demand for baseload electricity from grid systems. To whatever extent this doesn't occur, hydrogen by electrolysis is a flexible alternative.



Nuclear energy and hydrogen production

Nuclear power already produces electricity as a major energy carrier. The evolution of nuclear energy's role in hydrogen production in future decades could include:

- Electrolysis of water, using off-peak capacity
- Use of nuclear heat to assist steam reforming of natural gas
- High-temperature electrolysis of steam, using heat and electricity from nuclear reactors
- High-temperature thermochemical production using nuclear heat

Advantages of nuclear-electrolysis

- Zero-emission source of hydrogen
- Stable and predictable cost of hydrogen not linked to commodity prices such as natural gas
- Large-scale hydrogen production for oil sands upgrading facilities
- Robust and reliable hydrogen supply due to modular electrolysis platform and grid electricity backup

Zero-emission source of hydrogen for oil sands upgrading

Natural gas (NG) is currently used as the source of electricity, heat (steam) and hydrogen for oil sands extraction and upgrading activities. Alberta's planned expansion of oil sands will boost Canadian consumption of NG by 20% by 2015, over and above forecasted domestic consumption.

- Nuclear plants will be configured to supply thermal and electrical energy as required by particular oil sands projects
- One or more hydrogen production plants can be co-located with a nuclear plant to supply upgrader hydrogen requirements
- Upgrader electricity and hydrogen requirements can be supplied without producing greenhouse gas emissions

Hydrogen generation from advanced electrolysis platforms can be developed using nuclear power and is a compelling alternative to hydrogen from natural gas sources.

AECL and hydrogen

AECL is widely recognized around the world for its expertise in separating hydrogen isotopes. In particular, the company has developed several new processes based on water-hydrogen exchange, using a special "wetproofed" catalyst.

For the development of new hydrogen production processes, AECL is the technical participant for Canada on the Hydrogen Production Project Management Board at the Generation IV International Forum (the GIF). In this and through bilateral work with the US Department of Energy, Canada is doing development work on sulphur trioxide decomposition, which is a component of all of the sulphur-cycle processes for thermochemical hydrogen production, and on hydrogen production from copper chloride thermochemical cycles.

AECL has a long-standing interest in the production of hydrogen by conventional low-temperature electrolysis, particularly in the intermittent application of electricity to take advantage of fluctuating grid prices for electricity. This extends to our hybrid concept, NuWind, in which nuclear and wind sources are blended to affordably accommodate wind's intermittency for electrolytic hydrogen production.

For more information about the benefits of producing hydrogen using clean, safe, reliable and affordable CANDU nuclear power, visit our Web site: www.aecl.ca

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