New Zealand’s Progress towards Hydrogen and Fuel Cell Commercialisation

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Coverage

New Zealand Government Policy on Hydrogen

Areas of Activity

Work on Hydrogen

Work on Fuel Cells

Future Plans

Key Points
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NZ Government Policy

Policy Outcomes Addressed

- Sustainable use of Natural Resources,
- Reduction in emissions from Energy and Transport,
- Wealth from new Knowledge-based Industries,
- Innovative Manufacturing and Service Enterprises.

Move to a Hydrogen Rich Energy Economy
Science and Technology Focus

- Coal Combustion and Gasification,
- Gas Separation and Cleanup,
- Fuel Cell and Electrolyser Engineering,
- Electro-technology and Power Electronics,
- Mathematical, technical and Economic modeling,
- Renewable Energy transformation technologies,
- Dynamic Modeling of Hydrogen uptake in NZ.
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Hydrogen & Fuel Cell RD&D

Hydrogen energy research
  ▪ Production
  ▪ Storage and transportation
  ▪ Utilization

Hydrogen and distributed energy system integration
  ▪ Integrated distributed energy systems
  ▪ Renewable Energy forms,
  ▪ Combined Heat and Power (CHP)
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Work on Hydrogen and Fuel Cells

- **Hydrogen**
  - Research Projects 7
  - Demonstration Projects 3
  - Codes and Standards 0

- **Fuel Cells**
  - Research Projects 1
  - Demonstration Projects 4

Work needed on Codes and Standards
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Demonstrations

- Hydrogen RAPS, Rural Community, 2kW,
- Methanol Fuel Cell, Captive Power, 2kW,
- Grid interactive CHP Fuel Cell, 1kW,
- Wind Based RAPS Alkaline Fuel Cell, 2kW.

All Small Units Involved
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Research

- Hydrogen Production from NZ Coals,
- Fuel Cell System Integration,
- Associated Carbon Dioxide Sequestration,
- Water Electrolysis from Renewable Energy,
- Photo Electrochemical Hydrogen Production,
- Hydrogen Storage in Light Metal Hydrides,
- Hydrogen Storage in “sponge” Materials,
- Thermo Chemical Hydrogen Production.
A novel thermochemical cycle, initially based on NZ ironsand catalysts.
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Storage

Novel chemical-electrochemical processes to reform sodium borohydride from sodium borate

New Materials
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Utilization

Alkaline fuel cells

- System integration
- Balance of plant
- Electrodes

Distributed generation

- Micro Scale CHP
- Alcohol fuel reformers
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Totara Valley, New Zealand
Hydrogen distributed energy

Integration of hydrogen technologies,

Wind-electrolyzer-pipeline
Hydrogen storage and delivery of household energy,

Electricity – H2 fuel cell,

Water heating – Hydrogen combustion

![Pie chart showing energy usage categories]

- Water Heating
- Space Heating
- Refrigeration
- Cooking
- Lighting
- Other
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Totara Valley Farming Community, New Zealand – System Configuration

Wind energy

Electrolyser

Pipeline volume 1.3m³ @ 35psi

Fuel cell

Conditioned AC power

Super capacitor buffer

Heat loads

H₂ burner

2km distance
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Demonstrations and Field Trials

US DoD Residential PEM Fuel Cell Demonstration Project.
(Intl. Antarctic Centre, Christchurch, New Zealand)

- 2kW Fuel Cell, battery charging and lighting,
- Dual Fuel – methanol reformer with hydrogen cylinder backup.

Residential SOFC demonstration

- 1kWe grid connected integrated CHP energy system.
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Proposed New Initiative

Fuel Cell Based Residential micro CHP.

- Fuel Cell CHP Generator
  - Electricity
  - Heat

- Solar Energy Delivery (H/P)
- Fuel Cell Energy Delivery (CHP)
- Meter
- GRID

Purchased stored fuel
Free intermittent solar energy
Purchased / sold electricity
Combined heating and electrical demand
Key Points

New Zealand is Pursuing Hydrogen and Fuel Cells

- In Line with Government Policies on:
  - Sustainable Energy Supply,
  - National Self Reliance in Energy,
  - Environmental Protection,
  - Development of Knowledge based Industries.

No Work yet on Hydrogen Codes and Standards.
Currently only about US$ 5 million pa in RD & D.

- Expected to Increase in Future.

First Commercial Units targeted for 2012.