



## GlashusEtt - test facility

- Hammarby Sjöstad, Stockholm
- Environmental information centre
  - ≡ Open for the public
  - ≡ => Very good exposure and PR!
  - ≡ >20,000 visitors since Aug 2002
- A goal is to demonstrate future electricity and heat solutions
  - ≡ HYSTORY is one part
- Alternative energy system in full operation during 2003
- Cooperation project between ABB and Fortum
- Home page on [www.abb.se](http://www.abb.se)
  - ≡ Under Teknik > Innovationer > Alternativt energisystem i GlashusEtt



Building opened on June 4, 2002 by the King of Sweden





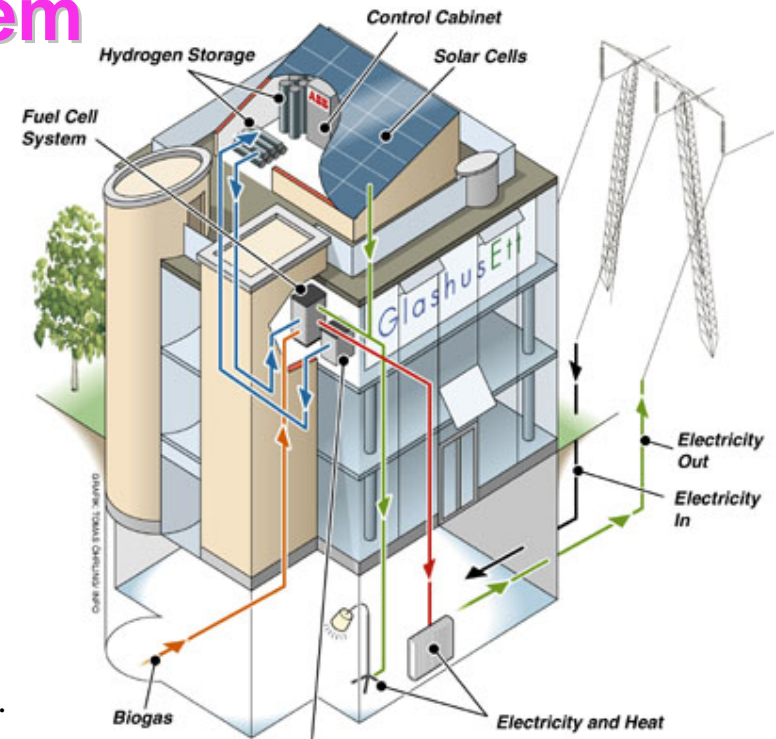
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## GlashusEtt – energy system

### → Renewable energy system components

- ≡ PV panels
  - 25 m<sup>2</sup> => 3 kW DC peak. ~2.5 MWh/year.
  - NAPS Sweden
- ≡ Electrolyser (PEM)
  - 0.7 Nm<sup>3</sup> H<sub>2</sub>/hour. Max 13.8 bar.
  - Proton Energy Systems
- ≡ Hydrogen storage
  - Pressurized. AGA (Linde Gas).
    - 22 bottles with 50 l water volume
    - 15 Nm<sup>3</sup> = 45 kWh (LHV) at 13.8 bar
  - MeH. 15 Nm<sup>3</sup>. From HYSTORY. Treibacher.
- ≡ Fuel cell 1 – H Power (now Plug Power) - PEM
  - Reformed biogas or hydrogen from electrolyser
  - 4 kW electricity + ≥6 kW heat
- ≡ Fuel cell 2 – Avista (now ReliOn) - PEM
  - Hydrogen from electrolyser
  - 1 kW electricity
- ≡ Control system - ABB





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## MeH installation – permission process

- **Discussions with authorities. From April, 2004.**
  - ⌘ First contact in June, 2003. First MeH installation in Sweden, besides university laboratories.
- **Application. July 8, 2004.**
  - ⌘ To “Town planning office”, City of Stockholm
  - ⌘ From responsible for operation (ABB)
  - ⌘ “Town planning office” does not have any technical expertise
  - ⌘ Circulation to technical authorities for comments, such as Swedish Rescue Services Agency and Fire Department in Stockholm. July 16, 2004.
- **Swedish Rescue Services Agency. October 5, 2004.**
  - ⌘ Submitted comments on the application
  - ⌘ Under certain conditions, to be fulfilled latest at the inspection meeting
- **Issue of permit for handling. October 8, 2004.**
  - ⌘ For “Handling of flammable goods”
  - ⌘ From “Town planning board”, City of Stockholm
- **Permission from owners of building. February 4, 2005.**
  - ⌘ Permission first granted in June 2004 but new reservations on November 5, 2004
  - ⌘ Caused 3 months delay because lawyers could not agree on formulation in agreement
- **Installation of metal hydride storage. March 2005 (planned).**
- **Inspection meeting on site. April 2005 (planned).**
  - ⌘ By Swedish Rescue Services Agency and other affected authorities
  - ⌘ Results in a protocol with comments to be considered
- **Issue of permit for operation. May 2005 (planned).**
  - ⌘ From “Town planning board”, City of Stockholm
  - ⌘ When all comments from the inspection meeting are considered



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## MeH installation – Conditions to fulfil 1

### ≡ Permit needed according to Swedish law

- Law (1988:868) about flammable and explosive goods
- Ordinance (1988:1145) about flammable and explosive goods
- Regulations from Swedish Rescue Services Agency
  - SÄIFS 1995:3. Permit to handle flammable gases and liquids. Includes general advice to the regulations. Only in Swedish.

### ≡ The equipment must be CE marked

- Mandatory ATEX (94/9/EC) directive
  - Equipment intended for use in potentially explosive atmospheres
- Swedish regulations
  - AFS 1995:5 Equipment for explosive environments. Issued by Swedish Work Environment Authority. In Swedish only.
  - ELSÄK-FS 1995:6 Electrical equipment for potentially explosive environment. Issued by “Elsäkerhetsverket”. In Swedish only.



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## MeH installation – Conditions to fulfil 2

### Classification plan of risk areas needed

- For areas with potentially explosive atmosphere
- European standard
  - EN 60079-10 Electrical apparatus for explosive gas atmospheres. Part 10: Classification of hazardous areas. European standard approved by CENELEC on 1995-11-28. Also issued in Swedish in SEK Handbok 426 by “Svenska Elektriska Kommissionen”.
  - Assumptions about leakage in the calculations is done by the responsible for the operation (= no standard method exists)
- Swedish regulations (in Swedish only)
  - SRVFS 2004:7 Environments with explosive risks when handling of explosive gases and liquids. Based on ATEX directive. Swedish Rescue Services Agency.
  - SÄIFS 1996:3. Prohibition and warning notices and marking of piping when handling flammable and explosive goods. Swedish Rescue Services Agency.
  - AFS 1999:6. Pressure vessels and other pressure arrangements. Including general advice. Swedish Work Environment Authority.



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## MeH installation – Conditions to fulfil 3

- ≡ Supplier documentation must be translated to Swedish
  - Material safety data sheet for hydrogen storage alloy
  - Safety aspects of metal hydrides and metal hydride storages
  - Operational and maintenance guide
- ≡ Risk analysis needed, since MeH tank was new in Sweden
  - Questions from authorities (examples)
    - What happens if metal hydrides leaks out in case of fire?
    - The temperature in the water mantle seems to be a critical parameter for the tank. How is it protected against over heating? Have you done any what-if analysis in case of failures in the control system?
- ≡ Conclusions
  - Many rules from several authorities involved
  - A guide “How to get a permit” would be nice to have