INSTALLATION PERMITTING GUIDANCE FOR HYDROGEN AND FUEL CELL STATIONARY APPLICATIONS (HYPER)

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HarmonHy

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Pro-Science

ARCOTRONICS GROUP

ARCOTRONICS FUEL CELLS

Sandia National Laboratories
Combustion Research Facility

HYPER CORE OBJECTIVES

The Focus of the Project is small stationary hydrogen and fuel cell systems to:

- **Develop an agreed installation permitting process with a fast track approval for safety and procedural issues**
- **Produce an Installation Permitting Guide (IPG) for developers, engineers, manufacturers, installers and authorities having jurisdiction and promote its acceptance and use across the European Union.**

A PlugPower natural gas fuelled CHP unit powers a greenhouse in Nancy, France.

A PlugPower GasCore© Fuel System in South Africa provides back-up power for telecommunications.

Stationary applications include systems:

- Connected to the power grid on stand alone including remote power
- Fuel Cell systems fuelled by natural gas, liquid hydrocarbon fuels, biogas, hydrogen
- Residential power and heat generation

A Vaillant fuel cell heating appliance, Oldenburg, Germany.

A PlugPower GasCore© Fuel System provides power to a telecommunication mast in Scotland, United Kingdom.

- Uninterrupted Power Supply (UPS) and backup systems
- Combined Heat Power Systems (CHP)
- Tri-generation systems (heat used)

HYPER Stakeholders Consultative Group (SCG)

- Ministry of Housing, Spatial Planning and the Environment-VROM-EV (Netherlands)
- Health and Safety Authority (Ireland)
- National Fire Corp (Italy)
- DVGW (Germany)
- KIWA Gastec (Netherlands)
- Ministere de l'Industrie-DGAP (France)
- Office of Technical Inspection- UDT (Poland)
- Regulatory Authority for Energy- RAE (Greece)
- UK Hydrogen Association (UK)
- Association pour la Promotion the l'Hydrogene et de ses Applications- ALPHEA (France)
- Italian Hydrogen and Fuel cell Association (Italy)
- Ducth Hydrogen and Fuel Cell Association- NWV (Netherlands)
- Association Francaise de l'Hydrogene (France)
- Hellenic Hydrogen Association (Greece)
- European Hydrogen association-EHA (Belgium/EU)
- Air Products (UK)
- London Hydrogen Partnership (UK)
- Dr Randy Dey (Canada)
- Professor Toshisuke Hirano (Japan)

Small H2 and FC Stationary Systems

- Virtual power plant project (FP5)
- HySafe (formal link will ensure IPG document legacy)
- EIHP
- Flame SOFC
- FCTESTQA
- FCTEDI
- HyAPPROVAL

- Validity of concept demonstrated
- Key technological components proven
- Costs and reliability need to be improved
- Regulations, codes and standards have to be adapted

Regulation, Codes, Standards (RCS) issues

- Need to examine all the existing standards, good practice guides,etc referring to the general use of hydrogen and FC produced by ISO TC197 , IEC TC105 Fuel, EIGA, CGA, NFPA, NASA
- No current European legislation and little national legislation covering installation of small stationary hydrogen systems
- Limited relevant RSC available to assist installers of hydrogen stationary systems
- Most RSC have been developed for large industrial hydrogen systems (NFPA 55 or NFPA 853 for stationary fuel cell application) or are based on behaviour of much denser and less buoyant products than hydrogen (usually hydrocarbon fuels)
- A number of existing/proposed codes and standards could be adapted to small industrial & domestic fuel cell markets

Hydrogen and Fuel Cell Regulations, Codes and Standards

Key /relevant items to take into account:

- **Fuel cells incl installation, siting- hardware/equipment-type of cell and fuel (natural gas, liquid gas, biogas, hydrogen); fuel storage and dispensing (esp for hydrogen)**
- **Boiler and pressure vessels**
- **Safety systems: fire protection, venting/exhaust, shut off systems, detection/sensors**
- **Interface with building (wiring, grounding, marking, control) and utility interconnection (gas, electricity)**
- **Testing and evaluation procedures (performance test, component acceptance), quality control**
- **Maintenance**
- **Operating instructions**

Stationary Applications: Relevant RSC

ISO/TR 15916:2004 Basic considerations for the safety of hydrogen systems
ISO TC197 WG8 ISO/DIS 22734-1 and ISO/CD 22734-2 Hydrogen generators using water electrolysis process. Part 1 Commercial and industrial applications.
Part 2: Residential applications
ISO TC 197 WG9 ISO/DIS 110-1 Hydrogen generators using fuel processing technologies.
Part 1: Safety
ISO TC197 WG13 ISO/NWIP 26142 Hydrogen detectors

IEC 62282 (Parts 1,2 and 3) Fuel cell technologies
US DOE Regulators' Guide to Permitting Hydrogen Technologies (in particular module 2 Permitting Stationary Fuel Cells Installations)
US/ NFPA 853 Installation of Stationary Fuel Cell Power Plant
EIGA / IGC 75/01/E/rev. Determination of safety distances
CGA G 5.5 Hydrogen vent systems
NASA Safety standards for hydrogen and Hydrogen systems. Guidelines for hydrogen systems design, material selection, operations, storage and transportation.

Installed systems must be CE marked and comply with a set of EU directives such as:
-machinery directive (98/37/EC)
-Low voltage directive (73/23/EEC)
-Electromagnetic compatibility directive (87/404/EEC, 90/448/EC)
- Cogeneration directive (2004/8/EC)

Areas with Lack of Pre-normative Research for Input to RSC

- Purpose of our experimental and modelling (CFD) to address critical safety issues relating to world examples of an H2 FC installation and provide insight into how to address issues of installation approval and compliance
- Safety distances – currently based on industry practice and are over cautious. Aim to reduce these (with sound scientific basis) for hydrogen powered systems. Need experimental data and further modelling to demonstrate this
- System failure
- Effects of barriers/walls, containment
- Leak detection, sensors

HYPER Contribution to RSC

A majority of HYPER Participants (Partners and members of the Stakeholders Consultative Group) play an active role in the development of hydrogen and fuel cells related European and International codes and standards

Ultimate aim of the project is to bring the IPG document into IEC as a new work item proposal and then under the IEC umbrella as an International Technical Report or Publicly Available Specification for use worldwide