European Hydrogen and Fuel Cell Technology Platform

European IG-RCS - Preliminary Gap Analysis

H2 Technologies
FC Technologies, Stationary & Portable FCs
Automotive Applications
January 2005 (Rev 2)

Considerations for Hydrogen RCS

Deployment Strategy Report - Targeted 'Snapshot 2020'

- Fulfill the goals of industry & the EU to create a commercially viable hydrogen energy & fuel market by 2020, initially focussing on the transportation sector with the underlying hydrogen manufacture, supply & distribution infrastructure.

Strategic Research Agenda Report

- FCs for vehicles major driver for FC development
- Stationary FCs major contribution to CO2 savings via CHP
- Portable FCs: substantial contribution to early market introduction of FC technology

Objective of 'RCS – Gaps Analysis'

- Present a status overview to be used as input to the future development of RCS
- Develop an understanding of the most urgently required initiatives in Europe related to development of H2 Regulations, Codes & Standards
- Use the 'RCS – Gap Analysis' to prepare an EU Action Plan to prioritise implementation, development and delivery of RCS

RCS - definitions

Regulations eg EU directives, national legislation, GTRs

- **Normally legally binding**, focused on functional requirements; can refer to codes/standards where more practical & technical requirements are described.
- Represent safety level(s) required by national authorities

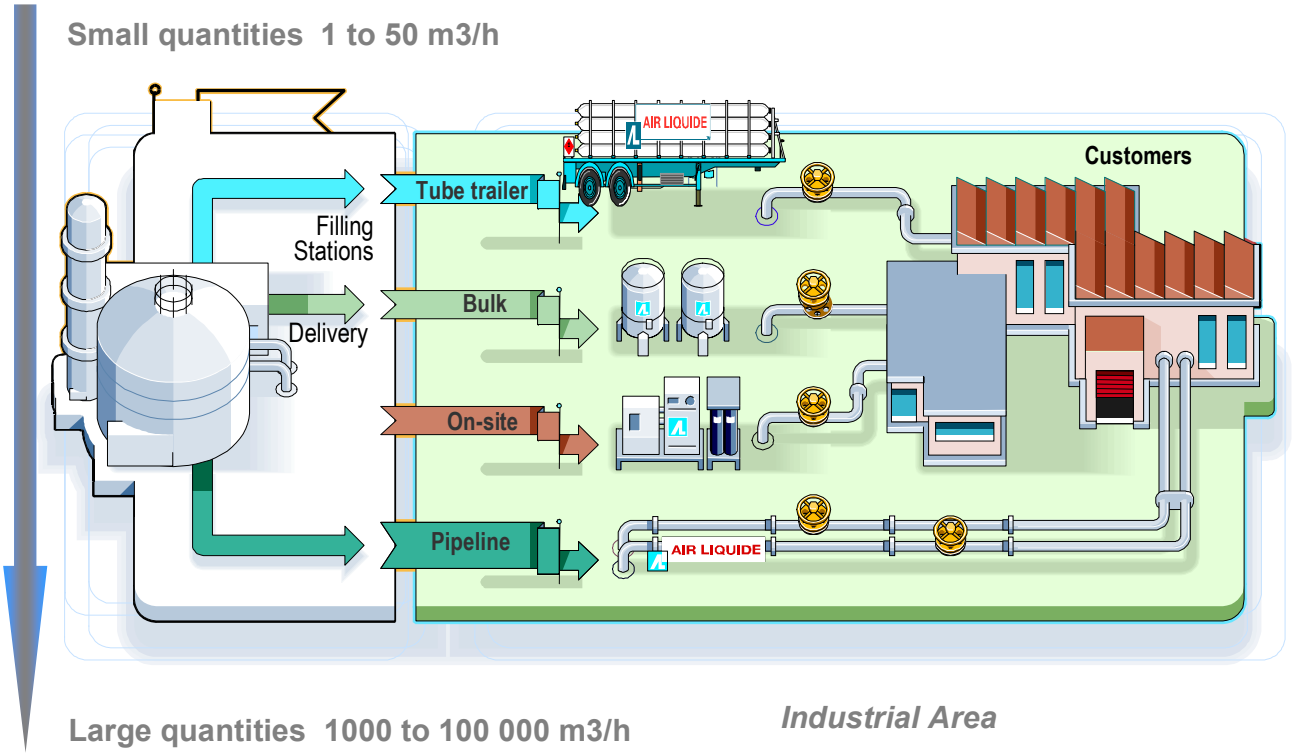
Standards eg ISO, IEC, represents industry convention

- **Define the physical form**: what the component(s) must be

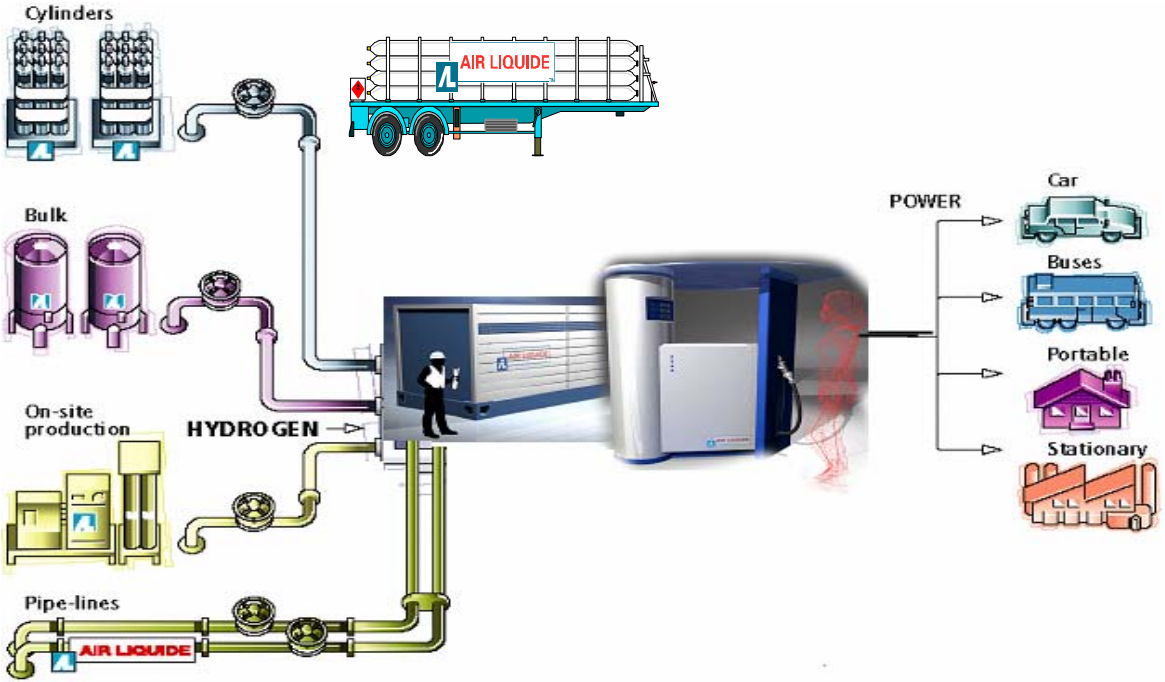
Codes (of practice) eg represents industry experience

- **Define the process**: how something should be done
- Provide design mechanisms for the **solution of routine problems**

The hydrogen industrial supply chain



The hydrogen retail supply chain



Source: Air Liquide

Analysis of Regulations, Codes & Standards (RCS) for Hydrogen/Fuel Cell Applications

Current Status

	RCS in place, and adequate for projected needs
	RCS in place, not adequate for projected needs
	No applicable RCS in place

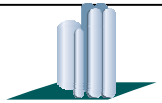
Productive Activity

	Significant activity
	Some level of activity
	No activity

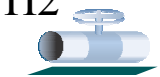
Future Outlook

	Direction appears adequate for business needs & commercialisation
	Direction may fall short of business needs & commercialisation
	Direction appears to be inadequate for business needs & commercialisation

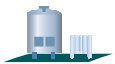
H2 Technologies - Production

		Current Status	Productive Activity	Future Outlook	Comments
Central Production					Established industry
Onsite Prod. Reforming					Local zoning ISO/ UL standard
Onsite Prod. Electrolysis					Local zoning ISO/ UL standard
Home Production					Not in 03 ICC code, will be in template, local zoning

H2 Technologies - Delivery

		Current Status	Productive Activity	Future Outlook	Comments
Delivery – HP composite					ASME including portable containers for DOT (US)
Delivery – HP conventional					ASME research activities
Delivery – cryo					Harmonization in progress
Pipelines					ASME recommendations
Tunnel Delivery					Review & change DOT (US) hazard class

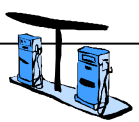
H2 Technologies - On-Site Bulk Storage

		Current Status	Productive Activity	Future Outlook	Comments
HP Composite					Standards activities initiated
HP Conventional					Research activities for higher strength material
Set-back					SNL tests underway, U of Miami, ICC, NFPA
Location above grade					SNL tests underway, ICC, NFPA codes
Below grade					Need for harmonisation in EIGA with CGA
Cryogenic					Well established technology (need for harmonisation of European regulation)
Set-back					SNL tests underway, ICC, NFPA Codes
Location					SNL tests underway, ICC, NFPA codes
Below grade					Need for Harmonisation in EIGA with CGA; CGA position paper. ICC (04 amend). NFPA

H2 Technologies - Fuel Dispensing

		Current Status	Productive Activity	Future Outlook	Comments
Equipment Nozzle (250/350)					ISO WG In testing CaFCP
Communication					SAE
Weights and Measures (gas)					In testing, CaFCP
W&M (liquid)					In testing CaFCP & Japan
Fuel Specification					In template: SAE, ASTM, API; ISO
Equipment (700) nozzle					Specs not started (SAE work in progress)
Liquid Dispenser					Some projects in Germany & Japan

H2 Technologies - Refuelling station site

		Current Status	Productive Activity	Future Outlook	Comments
Piping, electrical					In ICC 03 code and template
Proximity to other fuels					Not addressed yet, will be in 06 ICC
Safety Integration					Prevention of ignition sources, i.e. grounding, PPE
Building codes					ICC 03 codes, NFPA code
Canopy					ICC 06 amendment
Onsite Equip					Electrical and piping code changes applicable

Stationary applications

		Current Status	Productive Activity	Future Outlook	Comments / Existing
Residential, Remote site, Island, Power plants,UPS		🟡	🟡	🟢	NFPA 853NFPA 70, P1547,ASME PTC 50, ANSI Z 21.83,UL 1778, IEEE 1547
Forlift ,Ship		🔴	🔴	🟡	
Domestic cogen Residential cogen		🟢	🟡	🟢	Gas appliance direct
Recreative vehicle Vehicle onboard genset		🟡	🟡	🟢	
Telecom		🟡	🟡	🟢	NEBS ETSI

Portable applications

		Current Status	Productive Activity	Future Outlook	Comments /existing
Domestic genset					Interconnecting NFPA, UL,.
Catastrophe relief					Out of directives
Fair, market activities,events					Installation and using with public
Military field duty,					Out of directives,MIL
public recreation & boating					Combustible gas std

Automotive applications – design technology (EU)

	Current Status	Production Activity	Future Outlook	Comment
On-board storage system safety				ECE/GTR/FMVSS, CSA, ISO/TC197, SAE, Jari
Whole vehicle safety				ECE/GTR/FMVSS, ISO/TC22/SC21, SAE, Jari
Energy and environmental aspects				ECE/GTR/FMVSS, ISO/TC22/SC21, SAE, Jari

Future outlook – vehicle usage comparisons

	US	EU	J.	Comments
Parking (residential garage/other indoor)				Garage [not] in ICC 03 model code; EIHP2 actively studying issue; no existing Japanese prohibitions.
Driving				
Tunnels and vehicle movements				Japanese regulations do not differentiate between on-vehicle fuels. Product shipment another issue.
Service				Proposal rejected in Sept. ICC hearings. Japanese study underway for determining fuel proximity regulations

EU RCS 'Gap Analysis'-provisional conclusions

Status of European H2 Infrastructure:

- RCS for transport distribution applications exist
- RCS for environment do not
- Permitting Guide or Handbook needed for development of H2 refuelling stations

RCS financial resources handicap still exists for Europe, effort must be made to improve activities compared to US & Japan.

Summary & recommendations

- Use existing international regulatory & standardisation bodies (UN, ISO, IEC) and participate in these bodies more pro-actively
- Coordination of European interests in the field of regulations for road-vehicle applications needed
- Identify & harmonise EU regulations for approval of infrastructure as far as possible eg Proposal submitted for preparing 'Handbook for permitting of H2 refuelling stations' (EoI initiated from EIHP2 partnership)
- Avoid duplications & contradictory or inconsistent approaches