



The Joint Research Centre's contribution to cross-cutting activities of the FCH-JU

Marc Steen, G. Tsotridis, P. Moretto

<http://ie.jrc.ec.europa.eu>
marc.steen@ec.europa.eu

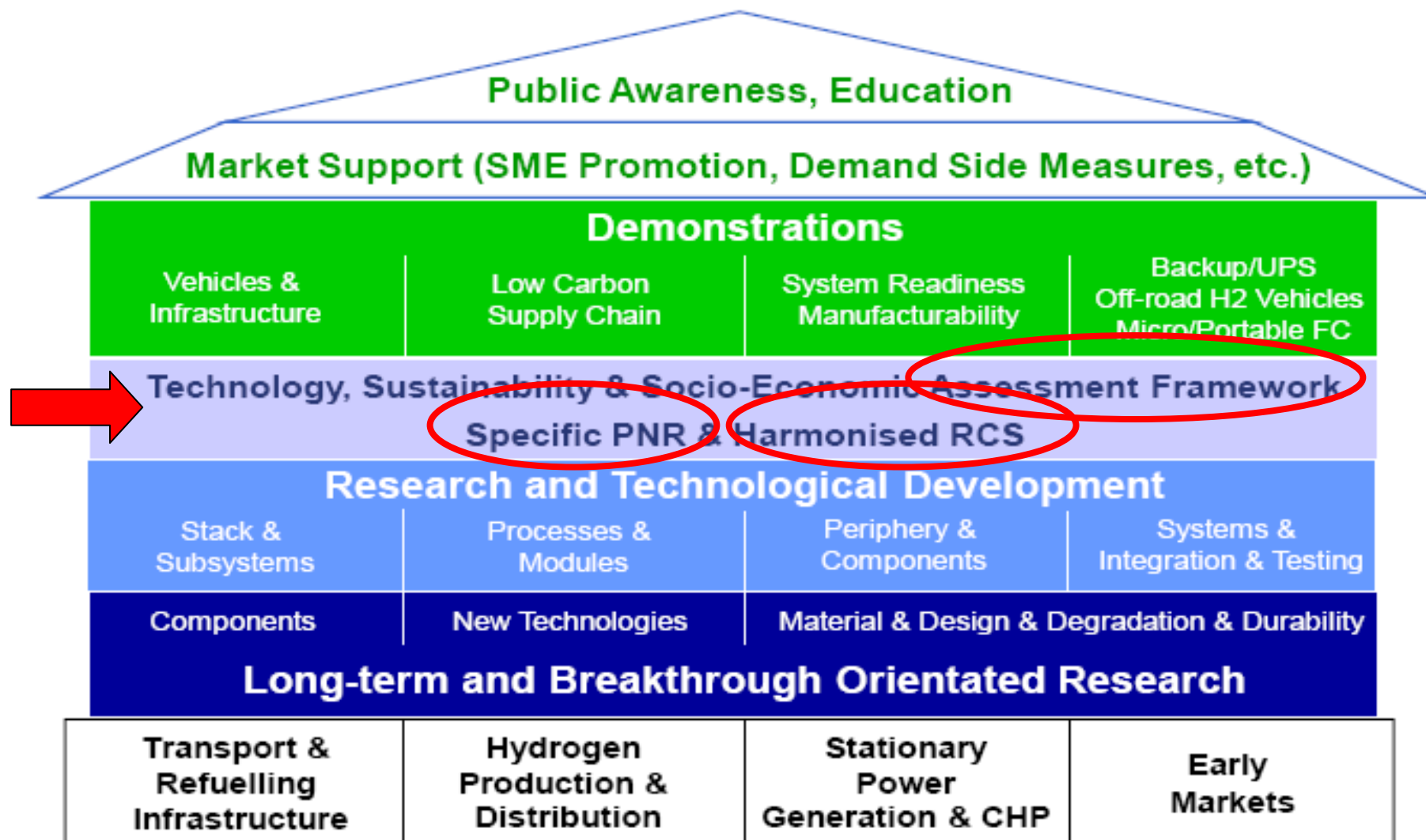


JRC Mission Statement

***to provide customer-driven scientific and technical support
for the conception, development, implementation and
monitoring of EU policies***

The JRC functions as a centre
of science and technology (S&T)
reference for the EU
independent of commercial
and national interests...





FCH-JU Framework Agreement with the Joint Research Centre:

- **Contribution to pre-normative research**
- **Provision of services as reference laboratory**
- **Support for formulation of FCH JU strategy**

+ participation to FCH-JU calls for proposals

Chapter 3.6 in MAIP

Cross-cutting JTI activities and JRC participation

	covered by JTI calls	JRC involvement in calls	JRC involvement beyond calls	international aspects
Regulations, Codes and Standards	indoor use of H2 & FC (2009, 2010)	✓	✓	IPHE RCS WG
Pre-Normative Research	composite containers (2009)	✓	✓	round robins, IPHE and IEA projects
	fuel quality (2009)	✓		
	power grid integration of FC	X		
Technology Monitoring Assessment	2008, 2009, 2010	✓		✓
Life Cycle Assessment	2008, 2009	✓	✓	✓
Market Support		X	X	
Public Awareness		X	X	
Education	2009	✓	✓	IPHE EWG

Pre-normative research as input to international standards and regulations

Execution of reference function in European Fuel Cell and Hydrogen Joint Technology Initiative

Scope:

- Fuel cell performance
- H₂ storage and distribution
- H₂ sensors
- H₂ safety

Representation of European Commission in international technical forums and collaboration activities:

IEA, IPHE, EU-US Energy Council Technology Working Group, ...

Supported by underpinning research in networking mode

Environmental and vibration testing of FC systems and their performance



tests at level of

- MEA
- cell
- stack



IEA-AFC, IPHE,
DoE, NEDO, KIST,
Dahlian Univ., RAS, ...

ISO TC 197, IEC TC 105
UN-ECE WP 29

RCS needs for FC (HarmonHy)

JRC

	<i>Categories</i>	
General	<i>Fuel quality</i>	X
	<i>Safety (in all the phases)</i>	
FC components	<i>Materials compatibility</i>	
	<i>MEA characterization</i>	X
FC stacks	<i>Materials compatibility</i>	
	<i>Characterization procedures</i>	X
	<i>Environmental tests: vibration and extreme conditions (e.g. saline atmosphere)</i>	X
FC system	<i>Balance of plant (electronics, thermal management) testing</i>	X
	<i>Fuel processor testing procedures</i>	
	<i>Environmental tests: vibration and extreme conditions (e.g. saline atmosphere)</i>	X
	<i>EMC (EMI) tests</i>	
FC applications	<i>Vehicle operations</i>	
	<i>Emission measurements</i>	X
	<i>Fuel consumption measurements</i>	X
	<i>Materials compatibility</i>	
	<i>Testing profiles</i>	
	<i>Refuelling interface</i>	X
	<i>H₂ sensors</i>	X
	<i>EMC (EMI) tests</i>	

direct JRC input to:

- IEC/TS 62282-1 2.0 Fuel cell technologies - Part 1 Terminology:
FCTESTNET Glossary
- draft IEC/TS 62282-7-1 Single cell test methods for PEFC:
experimental validation of testing procedures & protocols FCTES^{QA} STREP
- revision ISO/TS 14687-2:2008 Hydrogen fuel product specification, part 2: PEMFC applications for road vehicles:
validation of test protocols and assessment of effects of hydrogen fuel contaminants (and air pollutants) on PEFC performance
- convenor IEC/TC105 ad-hoc study group
evaluation of standardization needs for fuel cell systems for propulsion and APU
- Convenor IEC TC 105 ad-hoc group 1 forklifts
- use of reference H₂ fuel for type approval applications (*UNECE-HFV-SGE*)
- IPHE RCS WG

autothermal reformer

- up to 100 Nm³/hr H₂ peak capacity
- hydrogen quality 5.0 (99.999%)
- continuous monitoring of impurities
e.g. CO, H₂S



Task 23 IEA HIA small scale reformers – harmonisation of efficiency measurements

High Pressure H₂ Storage

GasTeF

Safety bunker for
stationary & cyclic
testing facility up to
800 bar



On-board safety sensors

SenTeF

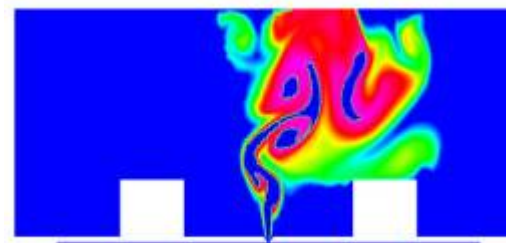
Laboratory for
sensor testing



Modeling H₂ release

2D and 3D CFD
codes

dispersion/explosion
modelling



refuelling stations
permitting

Solid-state H₂ Storage

SolTeF

Laboratory for
storage capacity
characterisation



ISO TC 197
EC type approval
UN-ECE WP 29

IEA-HIA, IPHE (ICHS)
NREL, JARI, ...



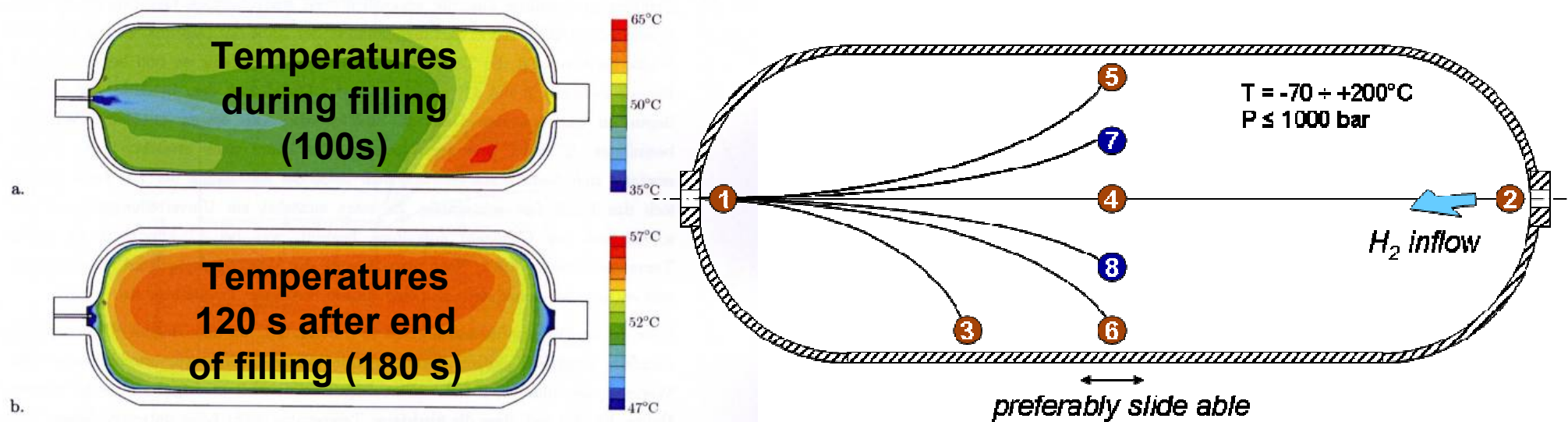
**N₂ liquid
storage**

**H₂ and CH₄
storage**

Compressor and tank testing “bunker”:

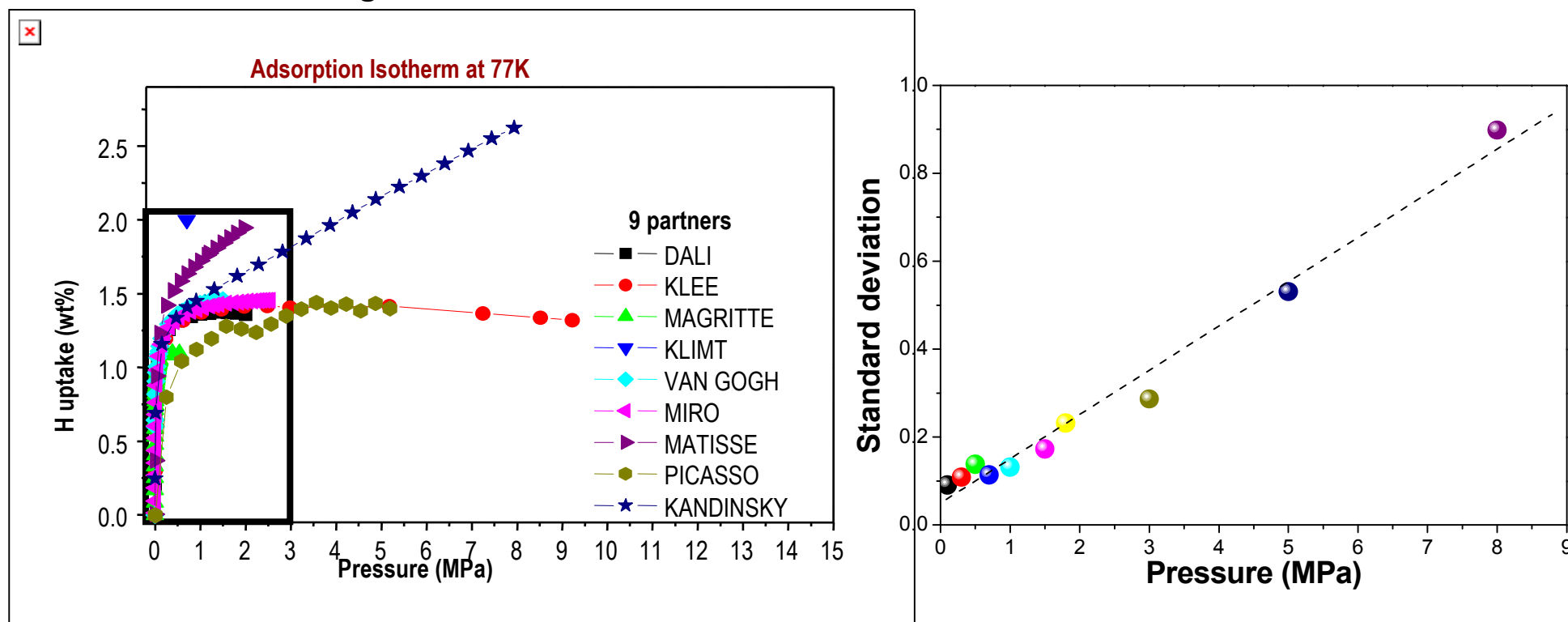
- 1 m thick composite walls
- 3 meters sand
- 40 tons sliding door
- 225 m³ interior filled with N₂ during tests

- ▶ measure temperature profile inside a tank during filling to validate software models



submitted to IJHE

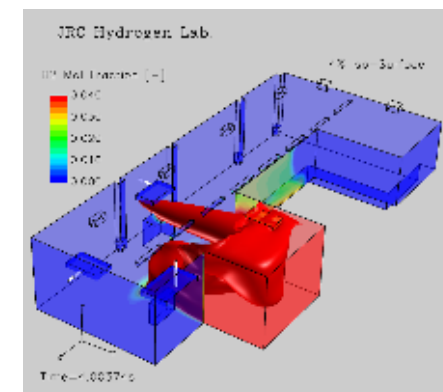
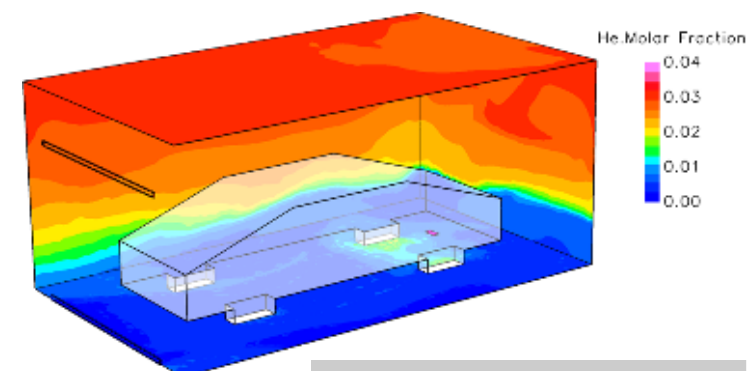
- organisation, participation, evaluation of first-ever global interlaboratory exercise on H₂ solid state storage – meanwhile 3 held



- continuous improvement of gravimetric measuring equipment

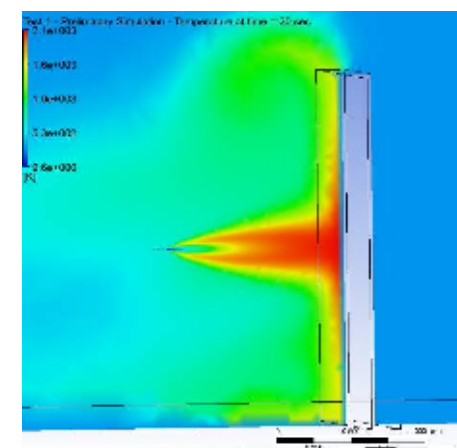
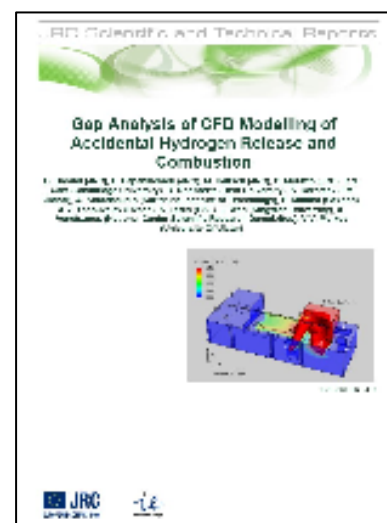
- numerical simulations

Environment	Release Dispersion	Explosions
Refuelling station		X
Garage	X	
Tunnels	X	X
Pipeline	X	
Urban street		X
Laboratory	X	



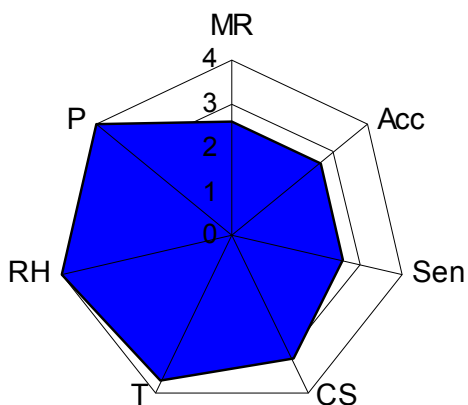
- simulations of fast filling procedure in hydrogen tanks

- gap analysis report on CFD simulations provided to FCH-JU

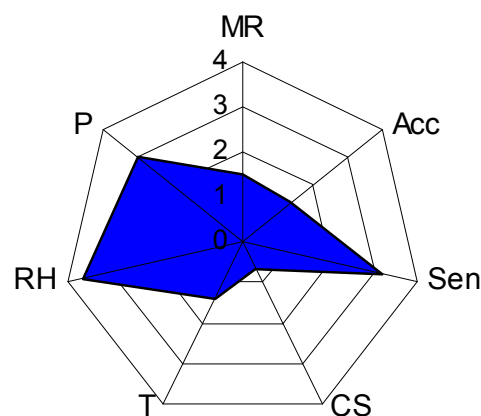


from individual parameter effect to performance evaluation: quantitative radar diagrams

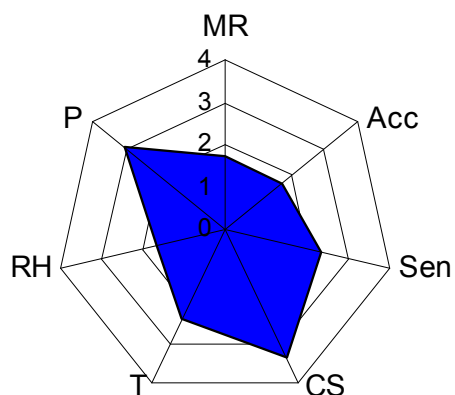
Catalytic Sensor (11/16)



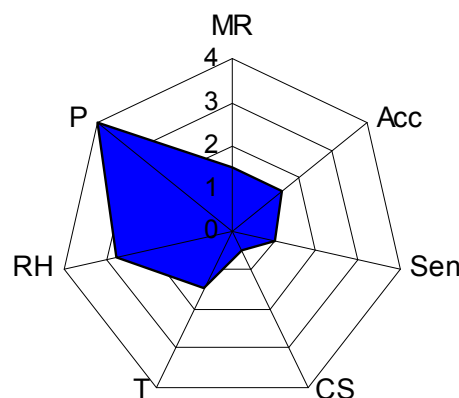
Electrochemical Sensor (8/10)



MOS Sensor (6/11)

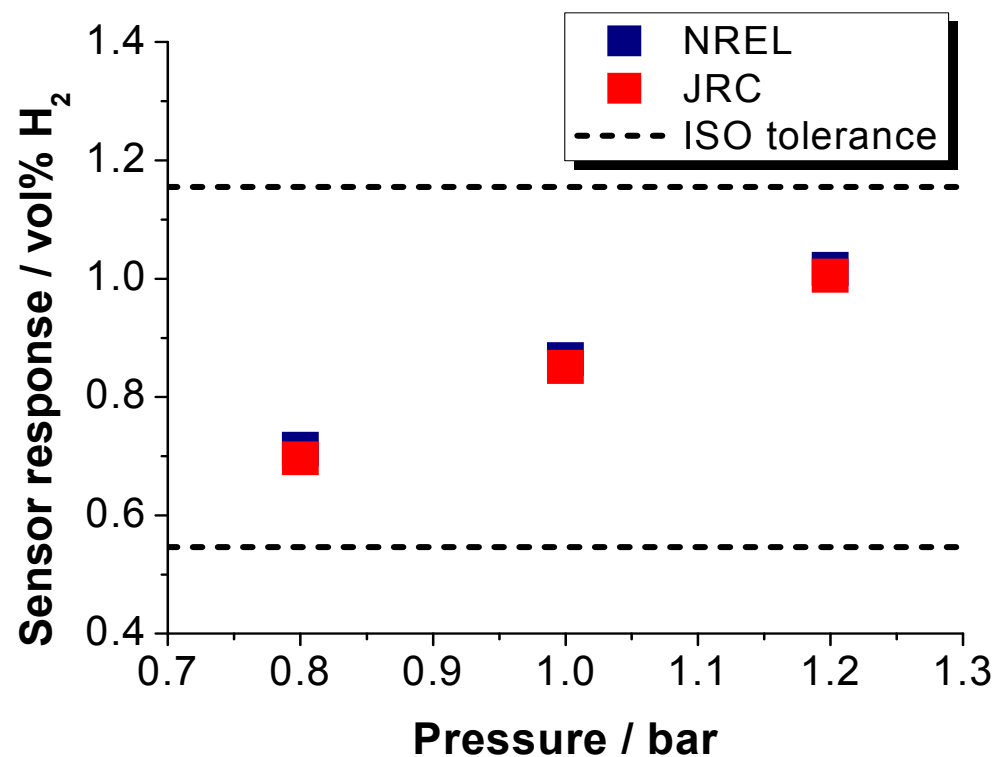
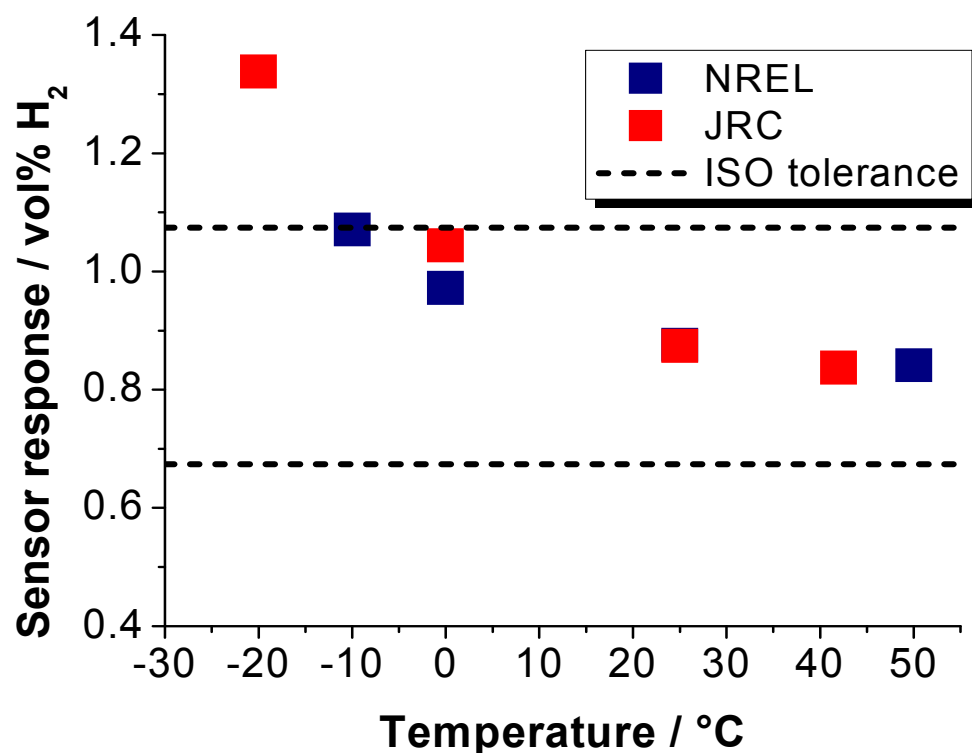


TC Sensor (2/3)



MR – measuring range
Acc – accuracy
Sen – sensitivity
CS – cross sensitivity
T - temperature
RH - relative humidity
P - pressure

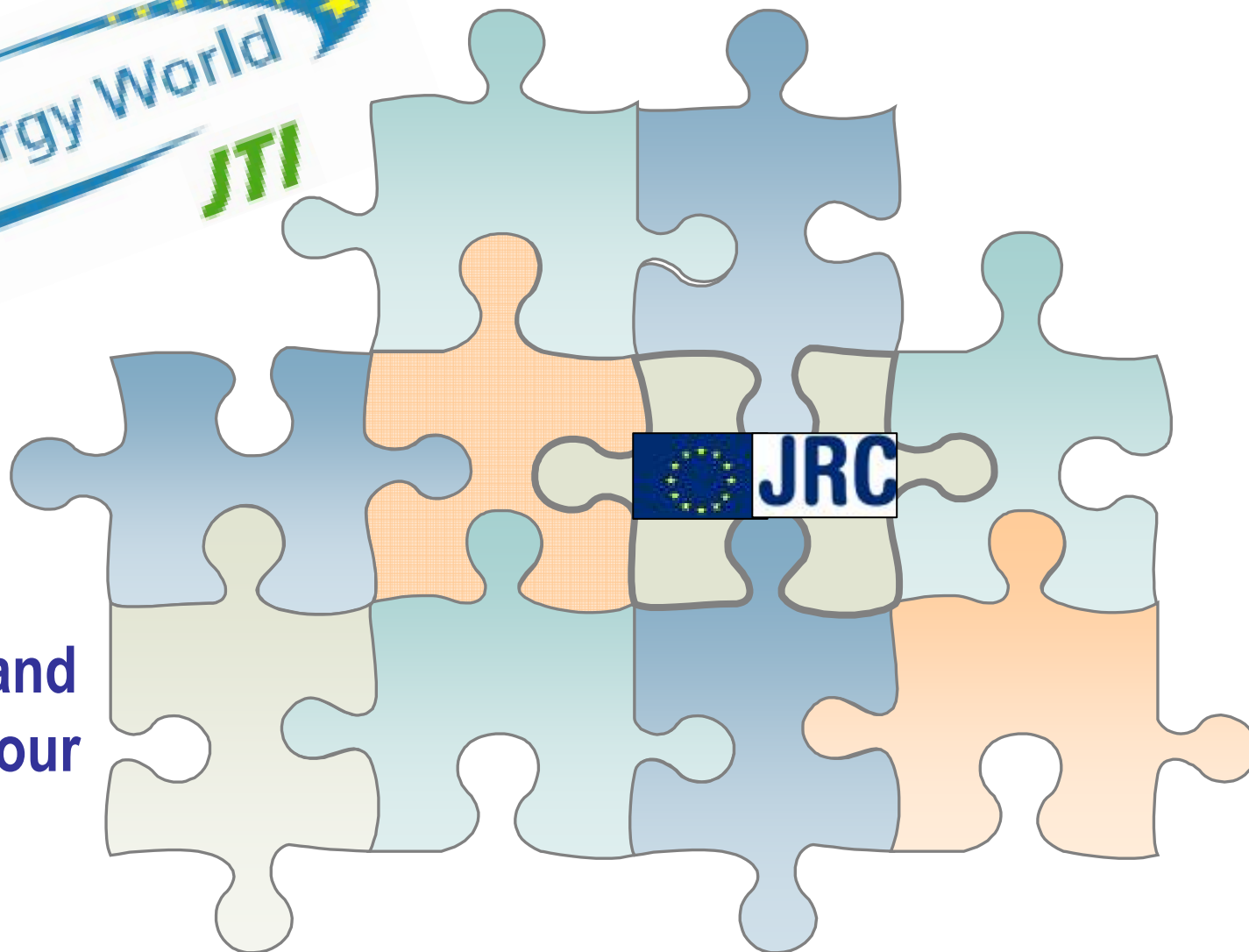
interlaboratory test programme to evaluate influence of environmental conditions (temperature, pressure, ...) on sensor response



direct JRC input to:

- ISO TC 197 WG 13 H₂ sensors
response and recovery time measurement
- HFCV type approval regulation + comitology regulation
expert on safety aspects on behalf of DG ENTR
- UNECE-HFV-SGS: type approval in Global Technical Regulation
id.
- IPHE RCSWG – safety aspects

- International Conferences on Hydrogen Safety (2005, 2007, 2009, 2011)
- IPHE Conferences on H₂ storage - (with US-DoE, Russia) (2005, 2009)
- International Workshops
 - Fuel Cell Degradation, 2007 (*IPHE*)
 - Accelerated Testing in Fuel Cells, 2008 (*IPHE*)
 - Diagnostic Tools for Fuel Cells Technologies, 2009 (*IPHE*)
 - Effects of Fuel and Air Quality to the Performance of Fuel Cells, 2009 (*IPHE, IEA-AFC, ISO*)
 - Early markets, 2010 (*IPHE, IEA-AFC*)
 - Fuel Cell Degradation, 2011 (*IPHE, IEA-AFC*)
- IAEA-IEA technical meetings on nuclear methods in H₂ storage and FC research, 2009-2010-2011
- **Hosting of researchers**



**Do contact us and
thank you for your
attention!**