



# FCH 2 JU

## Safety-related activities

ICHS 2017 -INTERNATIONAL CONFERENCE ON HYDROGEN SAFETY  
Hamburg, September 11<sup>th</sup> 2017

**BART BIEBUYCK**  
DIRECTOR OF FCH JU  
**Alberto GARCIA HOMBRADOS**  
Project officer cross cutting



[www.fch.europa.eu](http://www.fch.europa.eu)



# EU CLIMATE AND ENERGY FRAMEWORK



*“I want to reform and reorganise Europe’s energy policy in a new European Energy Union.”*

ENERGY SECURITY

BOOST EU  
COMPETITIVENESS

DECARBONISATION  
OF EU ECONOMY

20% CO2 REDUCTION  
20% REN. ENERGY SOURCES  
20% ENERGY EFFICIENCY

2020

40% CO2 REDUCTION  
27% REN. ENERGY SOURCES  
27% ENERGY EFFICIENCY

2030

80-95% CO2 REDUCTION  
~0% AIR POLLUTION

2050



# FCH 2 JU: Strong Public-Private Partnership with a focused objective

## Industry-led Public-Private Partnership (PPP)

### Fuel Cells & Hydrogen Joint Undertaking (FCH2 JU)



**Industry Grouping**  
About 105 members  
~ 50% SME



**Research Grouping**  
About 68 members



To implement an optimal research and innovation programme to bring FCH technologies to the point of market readiness by 2020

The Joint Undertaking is managed by a Governing Board composed of representatives of all three partners and lead by Industry.

**Legal basis:**  
Council Regulation: 559/2014 of 6 May 2014 (H2020)

# FCH 2 JU: Objectives for a green economy



## H<sub>2</sub> STORAGE FOR GRID BALANCING

Demonstrate on a large-scale hydrogen's capacity to harness power from renewables and support its integration into the energy system



## HEAT & ELECTRICITY PRODUCTION

Increase fuel cell efficiency and lifetime



## GREEN HYDROGEN PRODUCTION

Increase efficiency and reduce costs of hydrogen production, mainly from water electrolysis and renewables



## MINIMAL USE OF CRITICAL RAW MATERIALS

Reduce platinum loading



## CLEAN TRANSPORT

Reduce fuel cell system costs for transport applications

203 projects supported for 730 M€

*Similar leverage of private funding: 782 M€*

## ENERGY 114 projects

- Hydrogen production and distribution
- Hydrogen storage for renewable energy integration
- Fuel cells for power & combined heat & power generation

354 M€, 49%

## TRANSPORT 52 projects

- Road vehicles
- Non-road vehicles and machinery
- Refuelling infrastructure
- Maritime, rail and aviation applications

337 M€, 46%

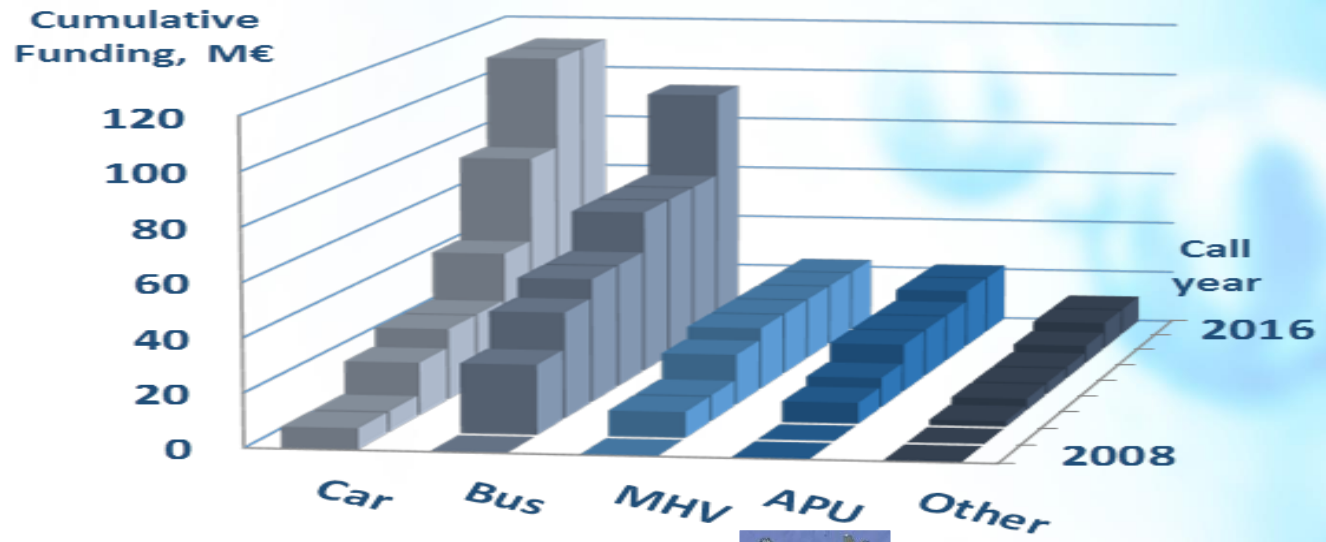
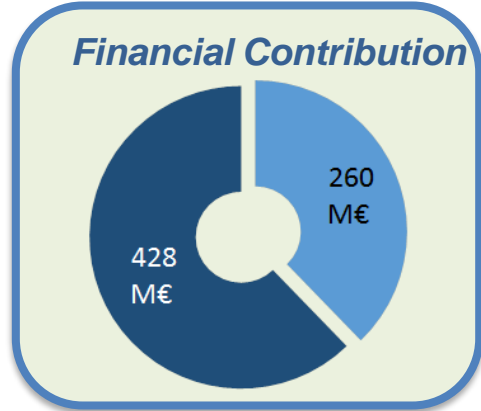
39 M€

## Cross-cutting, 34 projects

(e.g. standards, safety, education, consumer awareness, ...)

# Transport demonstration portfolio

27 projects  
260 M€




**From national plans to a EU strategy**

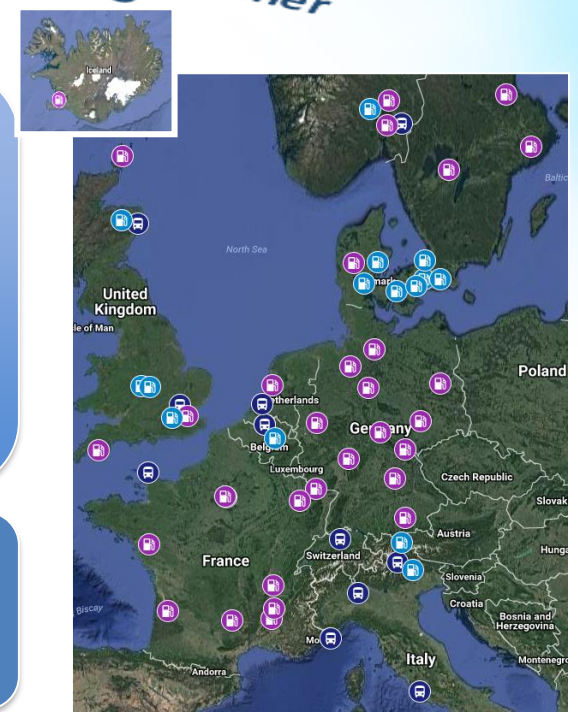
**From demo to a nascent 1.5 bn € market to 2020**




**First steps to EU business case**

- ✓ >250 MHV
- ✓ 10 sites

- ✓ >45 HRS
- ✓ >1,500 cars
- ✓ 206 buses in 19 cities



# TRANSPORT: Cars, Buses and HRS preparing the market!

## CARS



REFUELLING TIME (~3 min.)  
INCREASED RANGE (~650 km)  
HIGH AVAILABILITY (~90%)  
COST REDUCTION (~70k€)

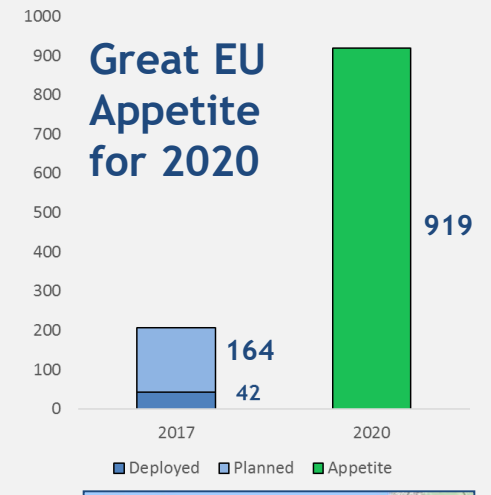


1000 FCV by the end of 2017 within reach

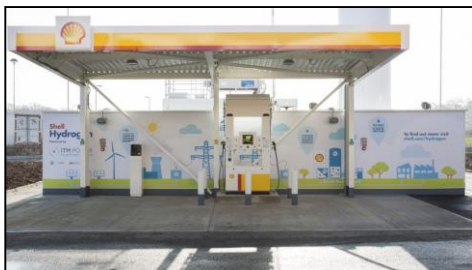
## BUSES



REFUELLING TIME (>10 min.)  
FULL OPERATION (12-20 daily duties)  
COST REDUCTION (~0.65M€)  
DECREASED FUEL CONSUMP. (8-12 kg/km)



## HRS



REFUELLING TIME (~3 min./ ~10 min.)  
HIGH AVAILABILITY (~96%)  
CAPEX (~1.5 M€)



# TRANSPORT: Emerging markets...

Other applications are crucial to the decarbonisation challenge

**MATERIAL  
HANDLING  
VEHICLES**



The FCH2 JU  
supports  
transport  
emerging  
markets for a  
cleaner future

**MARITIME  
APPLICATIONS**



**DRONES**



...

**AIRPLANES**



**TRAINS**



**TRUCKS**



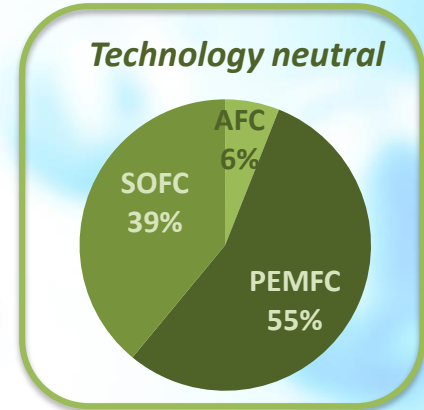
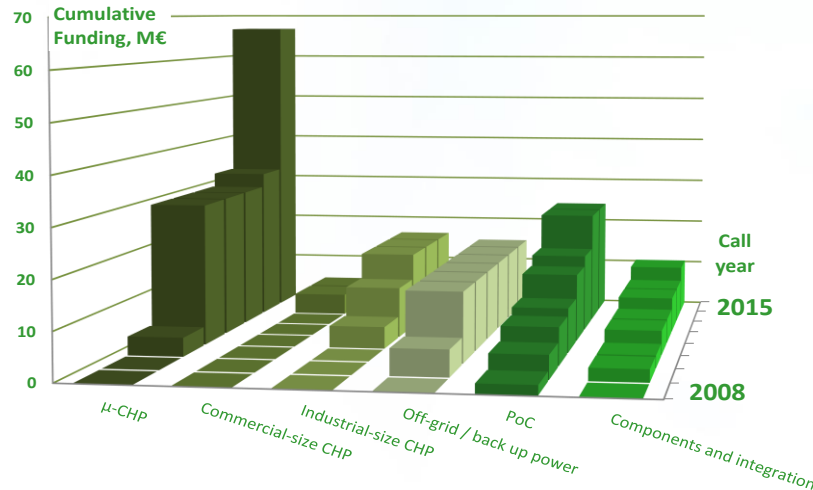
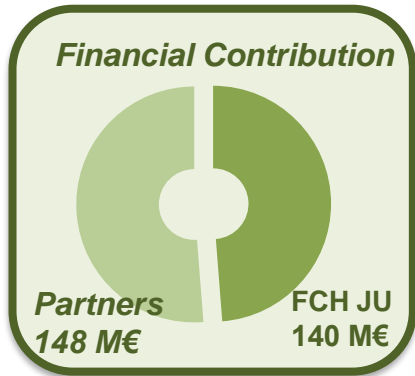
**BICYCLES**





# ENERGY: Increased support to field demonstration

## 27 projects for 140 M€



### EU supply chain for components

170 kW on biogas from wastewater treatment plant

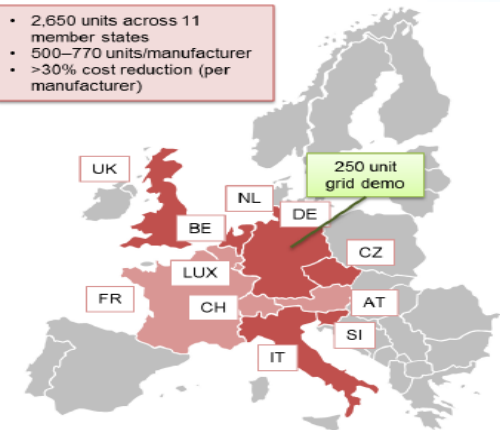


Pathway to a Competitive European FC mCHP market (over 3000 units)



Tens off-grid and back-up power for remote areas/ emerging economies

- 2,650 units across 11 member states
- 500–770 units/manufacturer
- >30% cost reduction (per manufacturer)



- Field trial + component supply or system integration + installer training
- Field trial + local support and installer training

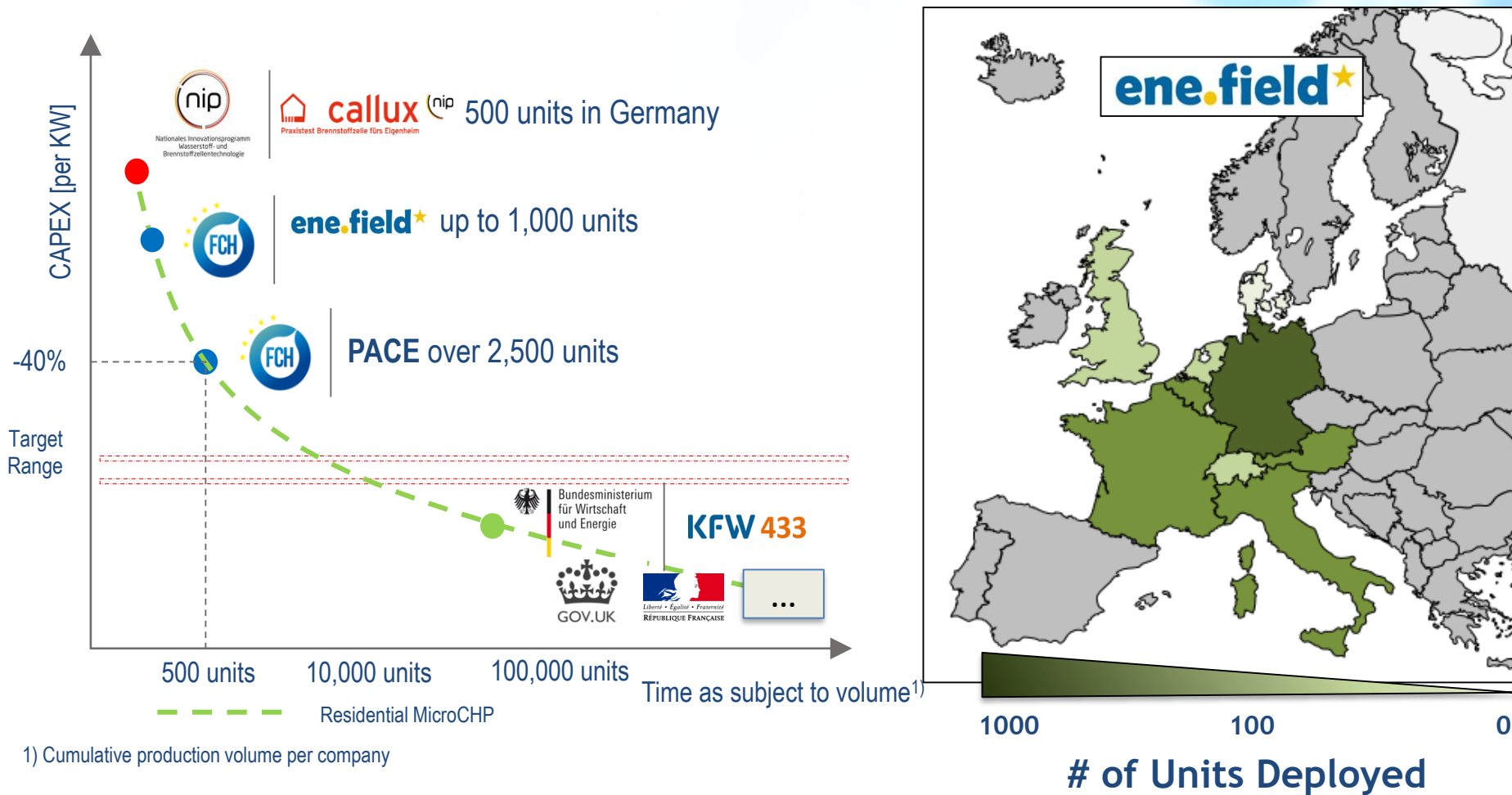
2 MW using waste H<sub>2</sub> from chlor-alkali plant in China



# ENERGY: m-CHP: from EU initiatives to National ones

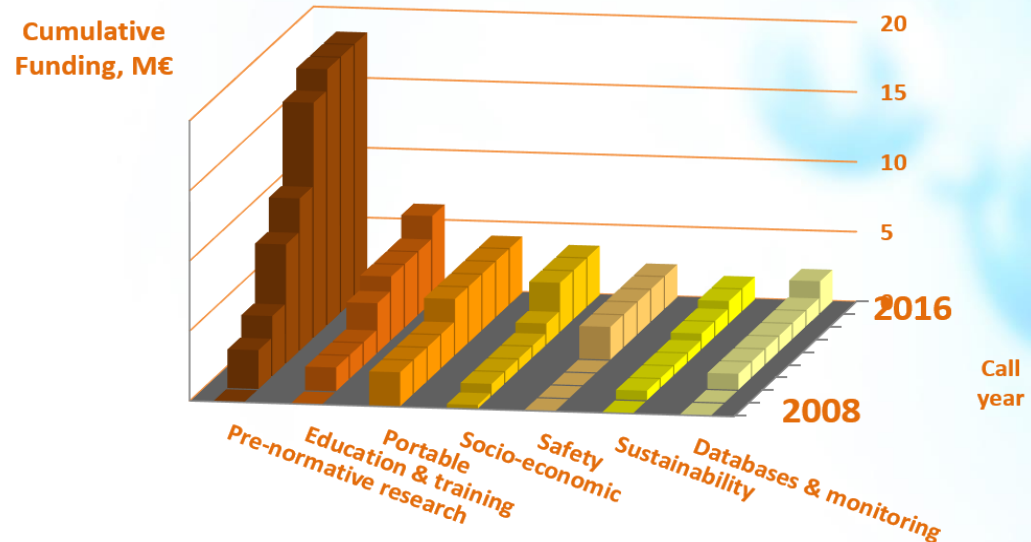
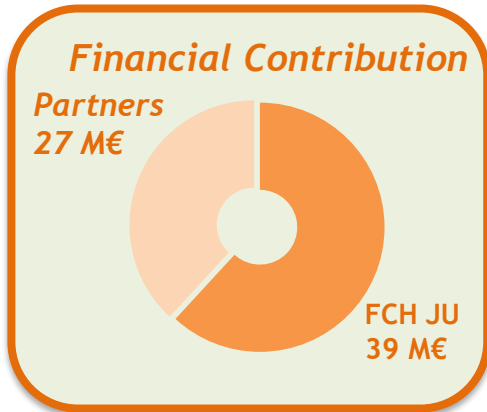
## *initial volume uptake, market readiness*

### Industry scaling up: from hundreds to thousands



1) Cumulative production volume per company

# CROSS-CUTTING Activity Area Projects Overview




Providing new knowledge to develop and improve regulations, codes and standards

Preparing the European workforce



Increasing public awareness and social acceptance

Ensuring FCH technologies are environmentally sustainable



34 Projects  
39 M€

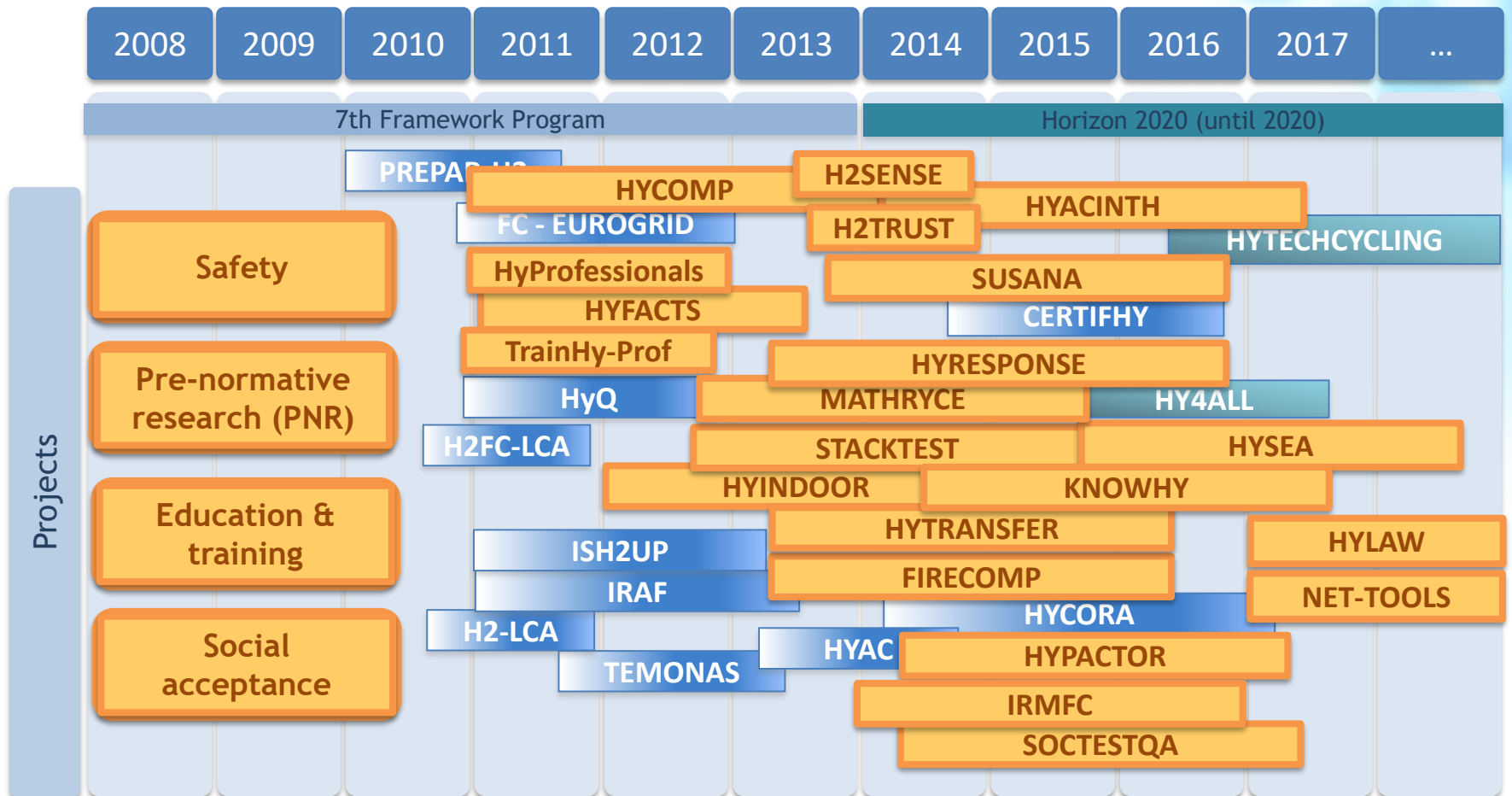
Addressing safety issues from multiple perspectives



# CROSS-CUTTING Activity Area

## Safety-related projects

Cross-cutting projects address safety from multiple perspectives

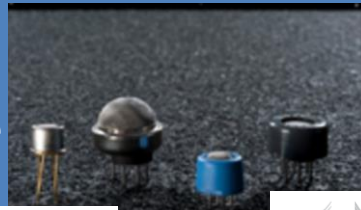


# CROSS-CUTTING Activity Area Safety-related projects

## An example of project outcomes

H2Sense

Hydrogen sensors for the safe use of H2



Main outcomes:

- Hydrogen Sensor Data Base (> 400 references) – publicly available
- Hydrogen sensing technology requirements
- Requirements for RCS
- Best practice strategies in guidelines
- Approaches to get more and better sensors on the market at a lower cost

The "H2Sense Hydrogen Sensor Database"

No.	Manufacturer City, Country	Sensor Model	Technology	Description / Remark	Application	Detection Range (%)	Certification / Approvals / Tests / Classification
3	Alphasense Ltd, Surrey, Norfolk, UK	HAZ	Electrochemical	Hydrogen-specific sensor element; Part of toxicologic gas sensors portfolio; "very low sensitivity to CO makes this one of the most selective hydrogen sensors on the market"	Emissions monitoring, process safety, environmental monitoring, volatile organic compounds (VOCs)	Limit of performance warning: 2000 ppm	n/a
7		ChA3	Catalytic Pelletor	Flammable gas sensor, not hydrogen-specific; small size (model 4)	fixed or portable application	0-100 % LEL methane	Sira DTATEX 3088X II 2 Ex d IIC T4 IECSa S907 0031X Ex d IIC T4 ISA 813 03000-423208 G I, L, RL, Div. 1 CSA Z2.2 1906133 Cl. 4B28 31
8		ChO3	Catalytic Pelletor	Flammable gas sensor, not hydrogen-specific; measure size (model 3)	portable application	0-100 % LEL methane	Sira DTATEX 3088X II 2 Ex d IIC T4 IECSa S907 0031X Ex d IIC T4 ISA 813 03000-423208 G I, L, RL, Div. 1 CSA Z2.2 1906133 Cl. 4B28 31
4	Asstec	3003.0	Electrochemical	Gas sensor transmitter, modular design	Industrial safety	0-1000 ppm	Ga Ex ia IIC T4 ATEX 910

The "H2Sense Hydrogen Sensor Database"

No.	Manufacturer City, Country	Sensor Model	Technology	Description / Remark	Application	Detection Range (%)	Certification / Approvals / Tests / Classification
10							
28		AST 4000	Mechanical Piezoresistive	Pressure sensor / transmitter adaptable to hydrogen sensing applying Krytox Bond™ Technology AST 4000 explosion proof, to withstand high vibration and temperature extremes	Industrial O&M & Hydrogen Equipment	0-100, 200, 500, 1000, 1500, 2000, 3000, 5000, 7000, 10000, 15000, 20000 Psi	CSA 30 (UL 1203/PM15) Class 1, Zone 1, Group HC CSA 30 Class 1, Div. 1, Groups A, B, C, D CSA 30 Class 2, Div. 1, Groups E, F, G (EN 60068-2-27 (Shock)) (EN 60068-2-6, 60068-2-64, IEC 68-2-32 (Vibration))
11							
10	Wachschalch AG, Nies, Switzerland, CH, CH	Lekator™ 10	Solid state / Semiconductor; patented	Combustible gas leak detector, hand-held, gases detected: hydrogen, etc.	Leak detection	10 ppm Sensitivity, methane-based	UL 913 Class 1, Div. 1, Groups A, B, C, D
12							
13	WENT Messtechnik Stollsdorf, Germany	GF2000n	Semiconductor	Gas warning system for hydrogen gas; hydrogen-specific device based on devices for toxic and combustible gases; Different technologies for different measurement ranges	Monitoring of areas with restricted or no accessibility, gas withdrawal from machines and exhaust pipes	min. 0-100 ppm max. 0-2000 ppm	n/a
14							
13	Wolter + Laine GmbH Melsdorf, Germany	Extraktor / Gasmonitor 10 1000	Electrochemical	Detects toxic gases, e.g. hydrogen, and oxygen, depending on specific sensor	Industrial safety equipment, monitoring of gas concentration and warning	0-1000 ppm (standard range); 0-2000 ppm (available)	IEC Directive 94/9/EC (Ex Monitor); I 2 G Ex ia IIC T4 Gb IPX (D) ATEX I 204 IEC Directive 94/9/EC Housing/Electronics: I 2 G Ex de [II] IIC T4 / Ex de IIC T5 (PFB certified) Measuring head: I 2 G Ex ia IIC T4 / I30 (PFB certified) BAM Performance Certification Instrument safety: EN 50270
7							
13							
14							

	Catalytic
Is it robust	Yes, minimum 2 M
Measuring range	0-1 % (process)
0.5 to 1 % (LFL)	++
Relative response time	Medium
Interference of non-flammable gases	No
Interference of flammable gases	Yes, response to all flammable gases in air, with some sensitivity
Responsibility for issues of poisoning substances	Yes, parameters include in process, such as sulphide, SO2, detected level, halogenated compound organic chlorophenyl compounds

Hydrogen sensors for the safe and reliable use of hydrogen

	Solid state / Semiconductor	Typ. cost
Is it robust	No	
Measuring range	++	++
0.5 to 1 % (LFL)	+	++
Relative response time	Slow	
Interference of non-flammable gases	No	
Interference of flammable gases	No	
Responsibility for issues of poisoning substances	Yes, SO2, H2S	

# FCH 2 JU safety-related activities

## On-going activities - Overview

FCH 2 JU approach towards safety includes several activities

### CROSS-CUTTING PROJECTS

- Safety, Pre-normative research, Education and training, Public awareness and social acceptance...



### REGULATIONS, CODES AND STANDARDS STRATEGY COORDINATION GROUP (RCS SCG)

- Set of priority areas
- Set of topics proposed for annual calls for proposals



### JRC – FCH 2 JU FRAMEWORK CONTRACT



- ANNUAL ROLLING PLANS: Activities set out
- RCS SCG, Harmonization, Safety, etc.

# FCH 2 JU safety-related activities

## Next activities: European Hydrogen Safety Panel

### FCH 2 JU is setting up a European Hydrogen Safety Panel

**hySafe**  
INTERNATIONAL ASSOCIATION  
FOR HYDROGEN SAFETY

**D. H2 Safety Panel**

The International Association for Hydrogen Safety (HySafe) was founded in 2009 by the members of the corresponding precursor, the EC Network of Excellence (NoE) HySafe, which was one of the first FP6 acknowledged projects. HySafe is an international non-profit organisation residing in Brussels. It is currently supported by 14 research centres, research institutes and universities representing 14 countries. HySafe provides unique opportunities for researchers from research institutes, universities and industry to meet at the international focal point on hydrogen safety.

Mr. Bart Biebuyck

Topic: **Providing information on the H2 Safety Panel**

Dear Mr. Biebuyck,

The international members of the FCH 2 JU were one of the main drivers of the FCH 2 JU. The international members of the FCH 2 JU were one of the main drivers of the FCH 2 JU. The international members of the FCH 2 JU were one of the main drivers of the FCH 2 JU.

**ANNEX to GB decision of 20/12/2016**

**FUEL CELLS and HYDROGEN 2 JOINT UNDERTAKING (FCH 2 JU)**

**2017 ANNUAL WORK PLAN and BUDGET**

In accordance with the Statutes of the FCH2 JU annexed to Council Regulation (EU) No 559/2014 and with [Article 31] of the Financial Rules of the FCH 2 JU. The annual work plan will be made publicly available after its adoption by the Governing Board.

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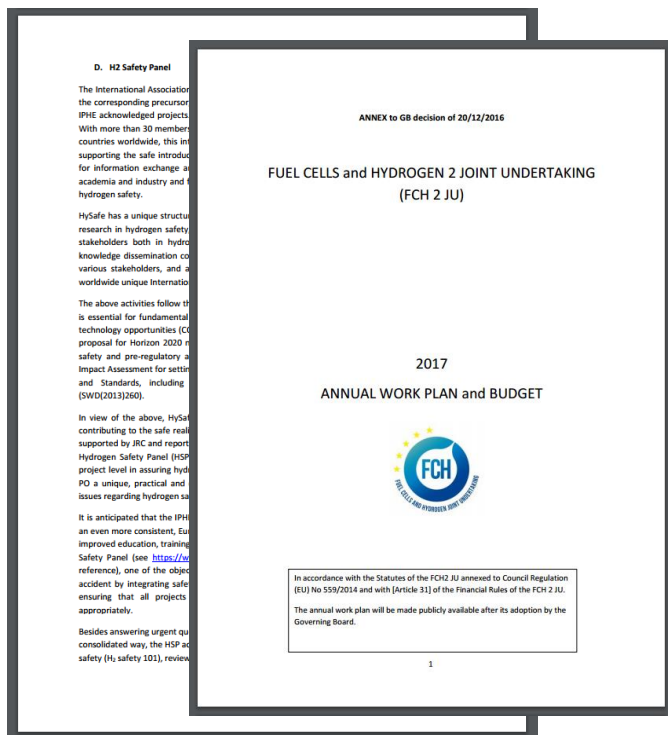
**To assist the FCH2 JU at both program and project level in assuring that hydrogen safety is adequately handled**

Reference:  
FCH2 JU Annual Work Plan - AWP2017. Action D. H2 Safety Panel

# FCH 2 JU approach towards safety

## Next activities: European Hydrogen Safety Panel

The European Hydrogen Safety Panel will assist FCH 2 JU in several areas:



Contributing to:

- FCH 2 JU proactive safety management
- Promote & disseminate H2 safety culture



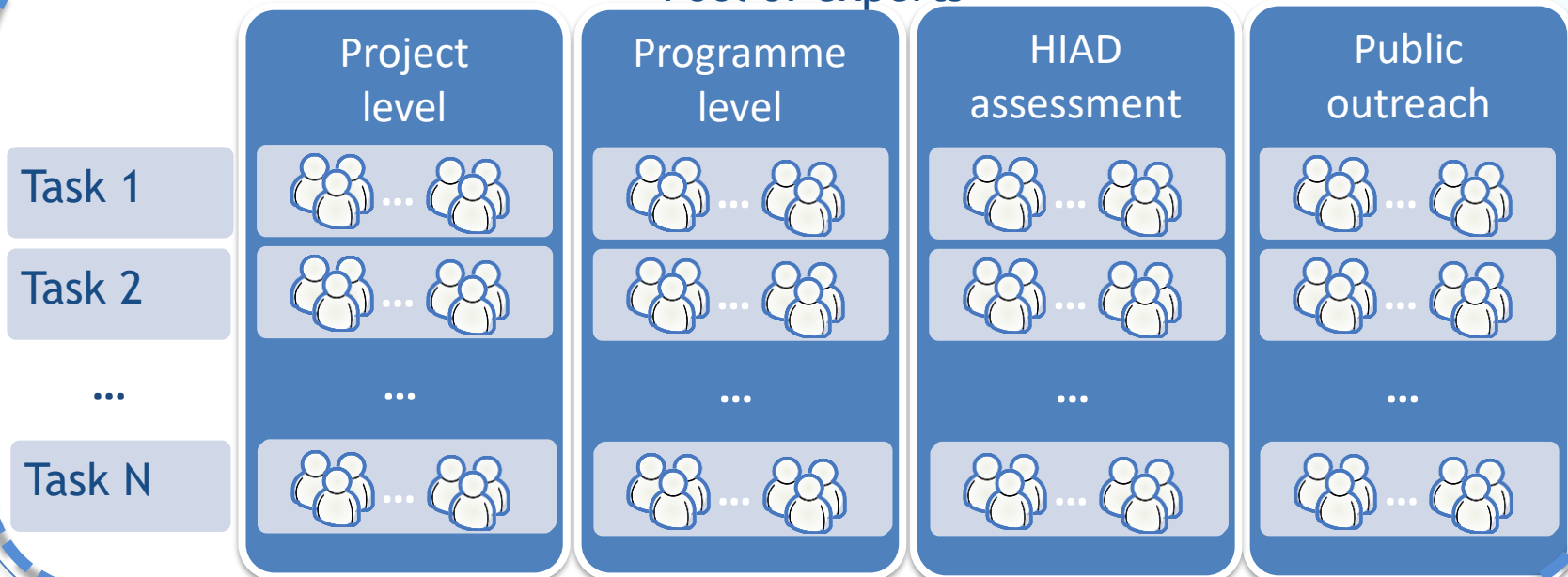
# FCH 2 JU approach towards safety

## Next activities: European Hydrogen Safety Panel

### European Hydrogen Safety Panel - Structure



#### Pool of experts

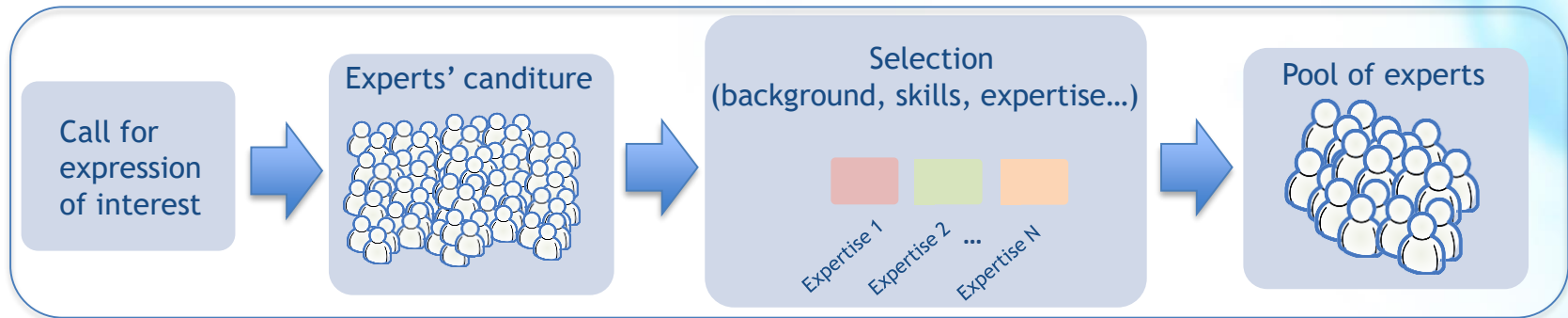


# FCH 2 JU approach towards safety

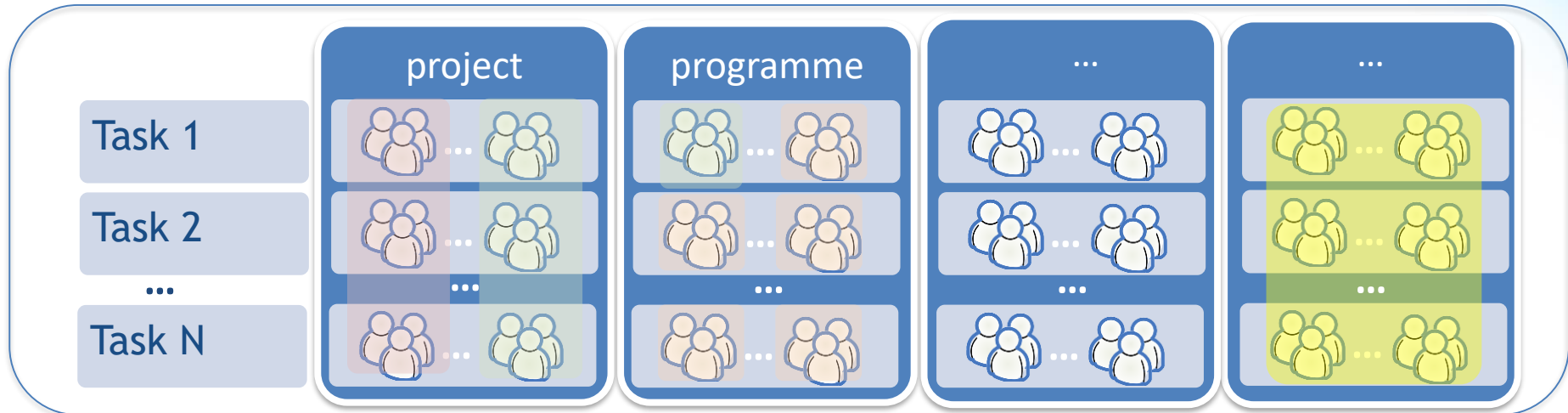
## Next activities: European Hydrogen Safety Panel

### European Hydrogen Safety Panel: Composition

#### Pool of experts - selection process overview



#### Multidisciplinary Task Forces (TF): Task/activity assignment

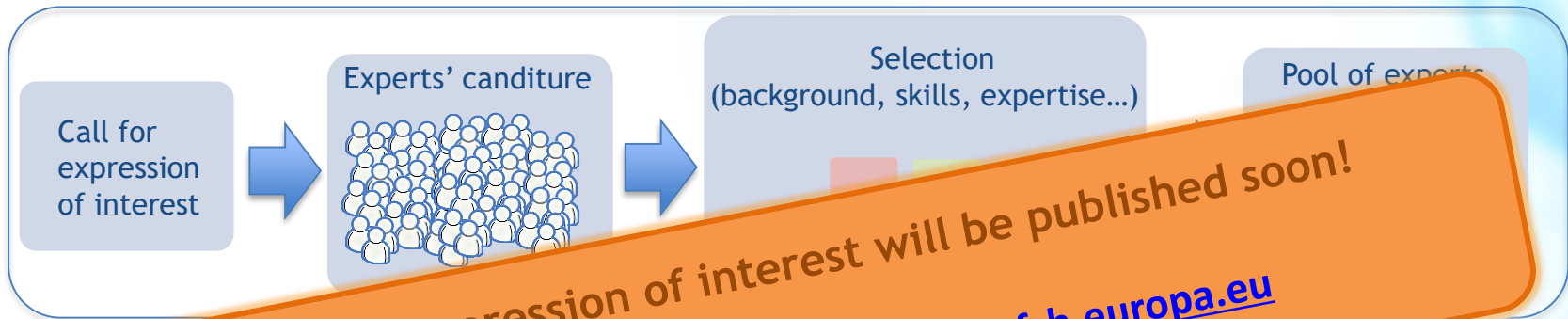


# FCH 2 JU approach towards safety

## Next activities: European Hydrogen Safety Panel

### European Hydrogen Safety Panel: Composition

Pool of experts - selection process overview



Multidisciplinary

Assignment





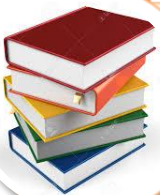
**A high degree of safety is essential for the commercialization of FCH technologies**



**FCH 2 JU commitment towards safety is sound, proactively promoting safety culture in Europe**



**Successful Cross-cutting projects outcomes bringing multiple benefits and providing tangible legacy**



**Complementary activities contribute to FCH community interests and increasing over time**

COMING UP....

## Join the FCH for the 10<sup>th</sup> year edition of the STAKEHOLDER FORUM



**Stakeholder Forum:**  
22 November 2017  
Steinbergher Hotel, Brussels

**Program Review Days:**  
23 and 24 November 2017  
Steinbergher Hotel, Brussels

FUEL CELLS AND HYDROGEN  
JOINT UNDERTAKING  
STAKEHOLDER FORUM 2017  
CELEBRATING

10<sup>TH</sup>  
E D I T I O N

TIME TO REFLECT AND TO ACCELERATE

# HYDROGEN FOR CLEAN TRANSPORT

FUEL CELL AND HYDROGEN INITIATIVES PAVING THE WAY IN EUROPE

22 September, Brussels

# Thank you for your attention !



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## Further info :

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