H2FC
EUROPEAN INFRASTRUCTURE

CAPACITIES

H2FC European Infrastructure Project

Integrating European Infrastructure to support science and development of Hydrogen- and Fuel Cell Technologies towards European Strategy for Sustainable, Competitive and Secure Energy

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H2FC European Infrastructure

General Overview

- **H2FC** European Infrastructure (*Integrating European Infrastructure to support science and development of hydrogen and fuel cells technologies towards European strategy for sustainable, competitive and secure energy*)
- 48 months (kick-off **01.11.2011** – finish **31.10.2015**)
- 19 European beneficiaries
- 10.3 Mio € overall project budget
- 8 Mio € financial contribution of European Commission (7FP; Capacities)
- Contract no. **284522**

Project and Partnership

1. Project achievements (1/7)

36 PM; 457.968,75 € [4,6%]

Networking Activities

- N 1 KIT — Entry Point
- N 2 UU — Technical School Researchers Exchange Programme
- N 3 SINTEF — Foresight Knowledge Innovation
- N 4 UP — Dissemination Public Relations
- N 5 KIT — Long Term Perspectives of H2FC

197 PM; 2.863.806,20 € [28%]

Transnational Access Activities

- TA 1 Transnational Access @ KIT
- TA 2 Transnational Access @ CEA
- TA 3 Transnational Access @ IFE
- TA 4 Transnational Access @ HSE
- TA 5 Transnational Access @ JRC
- TA 6 Transnational Access @ Jülich
- TA 7 Transnational Access @ PSI
- TA 8 Transnational Access @ NCSRD
- TA 9 Transnational Access @ UP
- TA 10 Transnational Access @ BAM
- TA 11 Transnational Access @ Tecnalia
- TA 12 Transnational Access @ NPL
- TA 13 Transnational Access @ SINTEF
- TA 14 Transnational Access @ EMPA

2.375.059,00 € [23,2%]

Joint Research Activities

- JRA 1 JRC — Facility Improvements for Investigation of Basic Hydrogen Properties and Material Behaviour
- JRA 2 Jülich — Facility Improvements for Investigations of Components and Systems of the Hydrogen Energy Chain
- JRA 3 CEA — Methods Protocols Benchmarking
- JRA 4 NCSRD — Cyber Laboratory

311 PM; 4.520.592,55 € [44,2%]

Goals, targets and approach

1. Project achievements (2/7)

H2FC European Infrastructure

Work content WP2 [N1]

- Operation the information management system and infrastructure portal
- Enhancing the outreach of new users
- H2FC European Infrastructure access service
- Review procedure under this proposal
- Development of web-portal for H2FC user groups

[N 1] KIT
Entry Point

Work content WP3 [N2]

- Technical School on hydrogen and fuel cells (structure, arrangements, participations)
- Researchers Exchange Programme (structure, arrangements, participations)

[N 2] UU
Technical School
Researchers Exchange Programme

Work content WP4 [N3]

- Specification of key scientific bottlenecks
- Mapping existing European research infrastructures facilities
- Tracking the achievements in an European annual progress review
- Defining the requirements and needs for improved research infrastructures
- New research facilities and modifications

[N 3] SINTEF
Foresight
Knowledge
Innovation

Goals, targets and approach

1. Project achievements (3/7)

H2FC EUROPEAN INFRASTRUCTURE

Work content WP5 [N4]

- Regional training and dialogue
- Consultancy to support regional developments
- Road Show
- Workshops
- Conferences

[N 4] UP
Dissemination
Public Relations

Work content WP6 [N5]

- Novel master degree "Resource Technology" as horizontal study
- **H2FC** Newsletter (2013) and Journal (beyond 2015)
- Sustainability of European e-infrastructure for **H2FC** research
- Possibilities concerning new research facilities and modifications
- Reference book: hydrogen safety technologies

[N 5] KIT
Long Term Perspectives
of H2FC

Goals, targets and approach

1. Project achievements (4/7)

[JRA 1] JRC
Facility Improvements for Investigation of Basic Hydrogen Properties and Material Behaviour

Work content WP7 [JRA1]

- Facility improvements and measurement to produce hypothetical hydrogen accident scenarios
- Facility and experiments improvement for safety assessment of materials behaviour using hydrogen sensors
- Development of measurements and analysis techniques for fuel quality

[JRA 2] Jülich
Facility Improvements for Investigations of Components and Systems of the Hydrogen Energy Chain

Work content WP8 [JRA2]

- Improvement of alkaline electrolyser installation in the power range of 0.5 to 5kW
- Extension of metallic vessel embrittlement test chamber to moist hydrogen
- Facility and measurement improvements for in-situ investigations of PEM fuel cells materials and components
- Facility and measurement improvements for investigation of high temperature fuel cells components and systems
- Improvement of test facilities for measuring the impact of fuel gas treatment on system degradation

Goals, targets and approach

1. Project achievements (5/7)

Work content WP9 [JRA3]

- Harmonised methodology for testing and improving fire resistance of onboard pressurized hydrogen storage
- Harmonised measurement for investigations of hydrogen solid storage materials and components
- Harmonised measurements for investigations of PEMFC fuel cell components
- Harmonisation of test procedure to study SOFC degradation upon application orientated conditions
- Round-robin exercise of the fuel quality measurements

[JRA 3] CEA
Methods
Protocols
Benchmarking

Work content WP10 [JRA4]

- Identification of existent physical models and numerical codes
- Round-robin testing
- Development of new models addressing scientific bottlenecks in priority areas
- Pre-test simulations of experiments on facilities of H2FC European Infrastructure
- Database of high quality experimental reference data for model validation
- Software suite for hydrogen and fuel cell systems

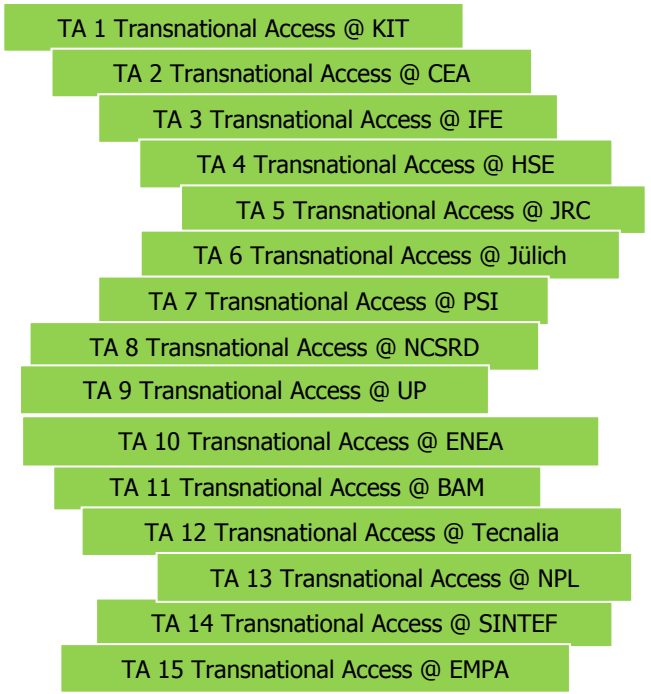
[JRA 4] NCSRD
Cyber Laboratory

Goals, targets and approach

1. Project achievements (6/7)

Work content WP11-25 [TA1 – TA15]

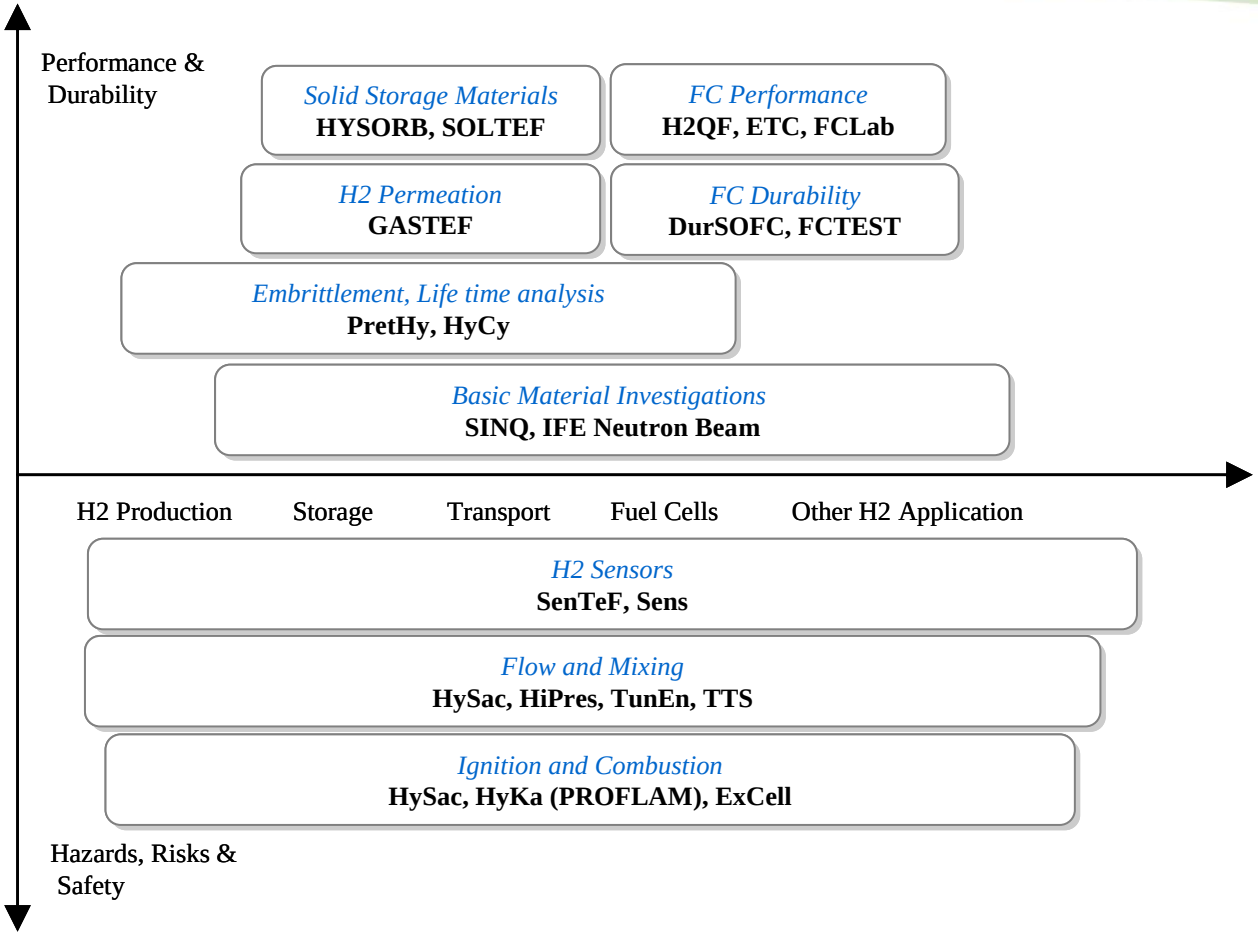
- Access to research infrastructure, divided into various technical installations
- Realising access and service to users regarding respective installations
- Planning and execution and technical pre-preparation of user experiments and tests
- Promotion and advice concerning access and possibilities to participate
- Publication and reports of results towards the users (or with users) towards the hydrogen and fuel cell community



Goals, targets and approach

1. Project achievements (7/7)

Portfolio of offered technical research installations



Alignment to MAIP/AIP

2. Alignment to MAIP/AIP (1/4)

Analysis of the scientific bottlenecks for commercialization of H2&FC technologies confirms, that the H2FC European infrastructure project is positioned on the following key issues:

- Test harmonisation and protocols
- Accelerated tests development
- Mechanisms understanding and modelling thanks to advanced characterisation means including in situ characterisation
- Safety issues

Alignment to MAIP/AIP

2. Alignment to MAIP/AIP (2/4)

Main topics of analysis (scientific bottlenecks)

- Hydrogen production (including purification)
- Hydrogen storage and distribution
- Hydrogen end-use / systems
- Cross-cutting issues

Sub topics: technology defined as key aspects

- Main materials challenges
- Limiting cost factors
- Limitations in characterization/modelling tools
- Main system challenges
- Main safety issues
- Main market challenges
- Other challenges

Alignment to MAIP/AIP

2. Alignment to MAIP/AIP (3/4)

- Identify and comment on gaps/bottlenecks in RTD&D proposed by MAIP/AIP documents

Comparison with: European Commission - Materials Roadmap Enabling Low Carbon Energy Technologies

- ***Ionic and electronic conductors*** *(for electrolytes, catalyst carriers, bipolar plates, gas diffusion layers)*
- ***Catalysts*** *(for low and high temperature applications and steam methane reforming)*
- ***Other functional materials*** *(for hydrogen purification, storage and thermo-mechanical cycles)*
- ***Structural materials*** *(for storage of pressurized (small and large scale), cryogenic and cryo-compressed H_2, transport of H_2, coal gasification, thermo-chemical cycles and sealants)*
- ***Novel materials*** *(advanced electrolytes, advanced catalysts, advanced photo-materials, advanced materials for H_2 storage)*

Alignment to MAIP/AIP

2. Alignment to MAIP/AIP (4/4)

- Identify and comment on gaps/bottlenecks in RTD&D proposed by MAIP/AIP documents

Comparison with: Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

- Transport & Refueling Infrastructure
  - Integration of fragmented PEMFC stack R&D is needed
  - RTD activities of importance are hydrogen quality requirements and standards, design and test criteria for high pressure composite and solid state storage tanks, fast refueling protocols and standards, crash tests and safety for hydrogen powered vehicles
- Hydrogen Production & Distribution
  - Demonstration on high volume, high safety hydrogen storage in synergy with energy storage requirements
- Stationary Power Generation & Combined Heat & Power
  - R&D on materials degradation/lifetime fundamentals

Alignment to MAIP/AIP

2. Alignment to MAIP/AIP (5/4)

- Identify and comment on gaps/bottlenecks in RTD&D proposed by MAIP/AIP documents

Comparison with: Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

- Early Markets
  - Reduction of cost for FC systems/optimization of BOP
  - improve efficiency and lifetime
  - enhance fuel supply for FC application (reduced hydrogen delivery cost, expand fuel cell sources, extend system operation time – improved storage systems)
- Cross-Cutting Issues
  - Evaluation of socio-economic, environmental and energy impact of FCH technologies
  - Coordination of Regulations, Codes and Standards strategy
  - Frameworks and schemes to help SMEs develop a supply chain for FCH technologies.

Cross-cutting issues

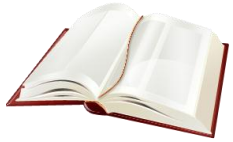
3. Cross-cutting issues (1/1)

- How project addresses and contributes to :
  - Training and Education (**H2FC** included special work package WP 3 [N2])
    - Technical School (annually)
    - Researcher Exchange Program (directed to external and internal personal)
  - Safety, Regulations, Codes and Standards (International Conference on Hydrogen Safety 2013 and also 2015)
  - Dissemination & public awareness (**H2FC** included special work package WP 3 [N2])
    - Conferences, workshops, public website www.h2fc.eu , newsletter, forum
- Information on publications
  - Own and special sessions on conferences (e.g.
  - Invited speakers
  - Talks (e.g. WHCE; Hydrogen & Fuel Cell Conference, Cancun), Poster, road show…

Enhancing cooperation and future perspective

4. Enhancing cooperation and future perspectives (1/3)

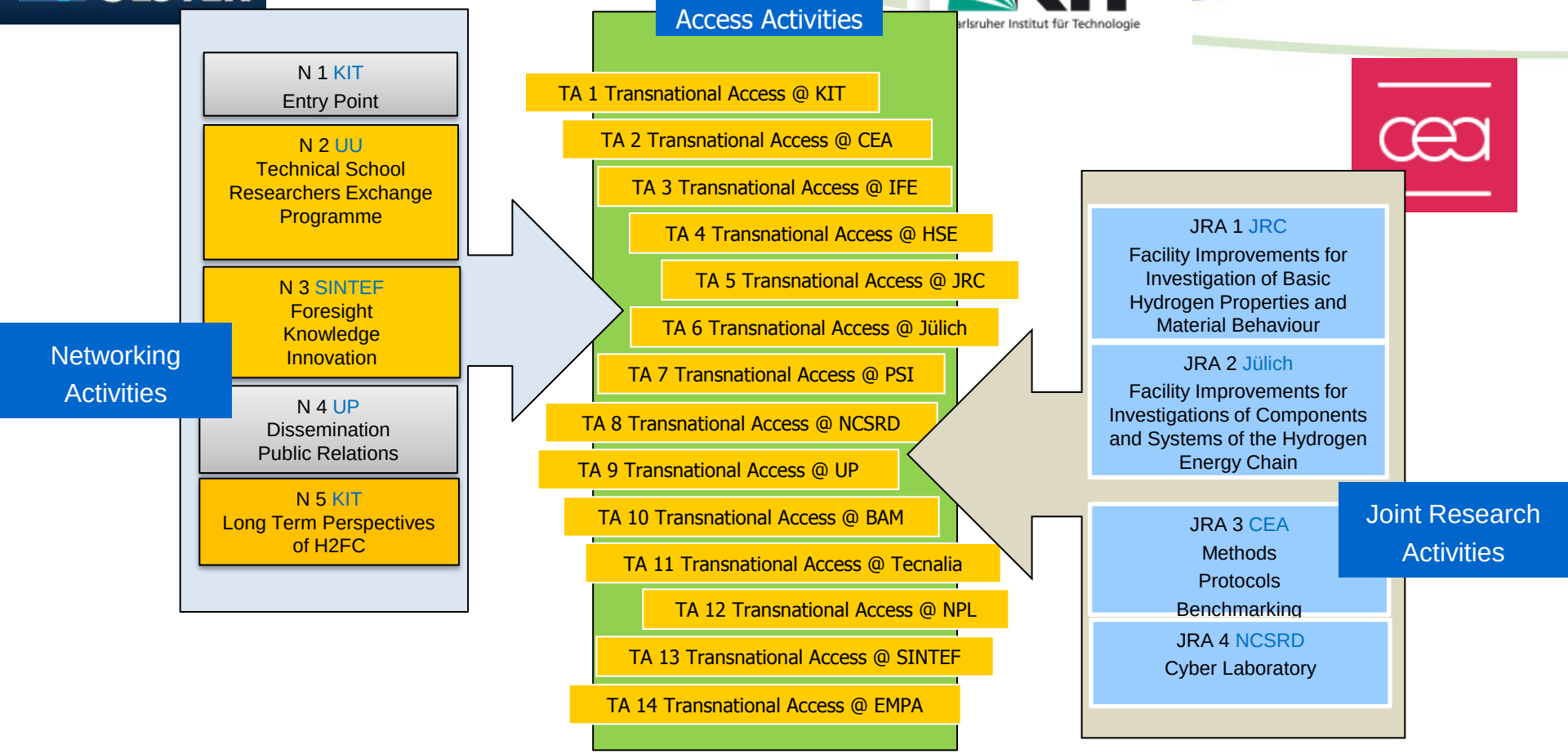
- Knowledge Transfer / Collaborations
  - Use of mailing list (newsletter starting 2013, prospective quarterly)
  - Journal (beyond 2015 prospective half yearly)
  - Reference Book (hydrogen safety technologies)



  - Development of study content and curriculum (master degree) on Energietechnologies (especially developing hydrogen society and influences)
  - Conferences (positioning of special sessions)
  - e-Infrastructure "**Cyber Laboratory**"
    - modeling and simulation tools addressing scientific bottlenecks
    - high quality experimental reference data
    - software suits

Enhancing cooperation and future perspective

4. Enhancing cooperation and future perspectives (2/3)



Enhancing cooperation and future perspective

4. Enhancing cooperation and future perspectives (3/3)

- Analyzing scientific, technical and economical bottlenecks (*which, where, who, why*)
  - Expert workshop 2013 (external and internal partners)
- Further on discussion on hydrogen technologies via forum
- e-infrastructure (cyber laboratory) to support hydrogen technologies
  - Modeling and Simulation and data base
  - Safety issues (in general)
  - Hydrogen storage
  - Fuel Cells

Many thanks for the invitation and your attention

Olaf Jedicke

H2FC

EUROPEAN RESEARCH INFRASTRUCTURE

HySafe

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NANOHy

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Under negotiation with FCH-JU

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