Grant agreement no.: FP7-284522

H_2FC

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

Deliverable

D 3.6	**3rd Technical School (European Technical School on Hydrogen and Fuel Cells 2014)**

Due date of deliverable	**31st October 2014**
Completion date of deliverable	**1st October 2014**
Dissemination level (CO, RE, PP, PU)	**PU**
Nature (other or report)	**report**
Version of deliverable	**1.0**
File name (share point version)	D 3.6_H2FC_Third Technical School_ vers.1.0.doc
Responsible partner for deliverable (acronym)	**UU**
Contributing partners (acronyms)	**UU**

The H_2FC project is co-funded by the European Commission within the 7th Framework Program

Deliverable approved by internal review person out of the consortium:

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Full name of reviewer of deliverable **Short name of organization (acronym)**	**Date of approval**
Olaf Jedicke KIT	15th October 2014

Comments by reviewer of deliverable:

(Comment boxes will be get emptied by coordinator before official submission via ECAS to European Commission)

No comments by reviewer to the content which appear really informative and sufficient, only small corrections done on first pages of deliverable report

Deliverable finished due date of Description of Work?

(Responsible person of the deliverable marks respective box by a cross)

YES ☺	**X**	**NO ☹**	

If NO explanatory statement by responsible person is requested!

No comments

Document History

Issue Date	Version	Changes Made/Comments
01.10.2014	1.0	Svetlana Tretsiakova-McNally

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1 Outline: European Technical School on Hydrogen and Fuel Cells 2014

1.1 Introduction

This document reports on the European Technical School on Hydrogen and Fuel Cells 2014 that took place from 23rd to 27th of June 2014 and organised by the University of Ulster (UU) within WP 3 'Technical School and Researchers Exchange Programme' of the H2FC project.

In 2014 the TS attracted 71 participants from universities, research institutions and industry around the globe. This year there were representatives from 19 countries. As in previous schools (TS2012 and TS2013), the vast majority of participants were from the EU. However, students, researchers, academics and professionals came from as far as India, China, USA, Saudi Arabia, South Africa, New Zealand, Ukraine and Israel. Of 71 participants, 45 (63%) were external to the H2FC project, whilst 26 came from partner organisations of the project. It is worth mentioning that among 45 externals, 33 participants were self-funded and 12 were funded by the project.

The audience of TS2014 consisted of post-graduate students (MSc and PhD), early career researchers, industrialists and scientists representing three communities: hydrogen safety, hydrogen production and storage, and fuel cells. With this in mind, the TS structure was tailored to provide maximum synergy and cross-fertilization between these areas. The entirely new programme of TS2014 included 9 lectures on topics of interests for the development and exploitation of H2FC European Infrastructure. In addition to topical lectures, a workshop on transnational access and instrumentation methods, Cyber Laboratory (modelling) session and an advanced research workshop were the main structural elements of the TS2014 programme. Each session was followed either by panel or round table discussions. The results of ongoing research were presented during work-in-progress poster session. The hands-on training was organised for the new H2FC Sage Framework, developed within WP10 (JRA 4) of the project, which was especially adjusted to hydrogen and fuel cell models.

The feedback from the participants was overwhelmingly positive. Many of them highlighted an excellent programme and selection of invited speakers. The participants recognised high quality of lectures and presentations delivered by Bert de Colvenaer (Fuel Cell and Hydrogen Joint Undertaking), Jay Keller (US Department of Energy), Tim Mays (University of Bath), Anthony Kucernak (Imperial College London), Guy Dang-Nhu (Air Liquide), Andreas Zuttel (EMPA partner). The students in their feedback forms mentioned the unique atmosphere of the school and opportunities to get involved in the discussions with top professionals and experts in the field of interest.

2 Preparation of TS2014

2.1 Location and timing of TS2014

In line with the Description of Work (DoW), UU led planning of the third European Technical School on Hydrogen and Fuel Cells 2014 with a guidance and direction from the School Board (SB), members of which are listed in the text of the deliverable D3.2. Preparation for the TS2014 commenced in August 2013. The timing of TS2014 was shifted to June rather than September. The rationale for this change was to facilitate financial reporting by UU partner in the end of the project. In practice, it

takes several months to ensure all invoices have been paid and all financial issues are closed. The period of July and August conflicts with the vocation period and is also significantly more expensive, hence June was suggested. UU have checked the dates against other events. The proposed dates were check-in on Sunday the 22nd June 2014 and check-out on Saturday the 28th June 2014.

At the initial planning stages, we have searched for an appropriate venue for the TS2014. At the time, we estimated at least 60 attendees to TS2014. UU have solicited a feedback from H2FC partners, SB members and the participants of second TS (TS2013) regarding the location as of the TS2014. UU has received unanimous positive feedback regarding the location of the second technical school; the feedback forms indicated a strong preference for either Greece again or a southern European location. However, we were very conscious of the perception of holding the event in either a "holiday" location, or indeed in the same region several times. With this in mind we have contacted more than 20 locations, both in Northern Ireland, and from the established conference and workshop venues around Europe. A summary of quotations received is shown in Annex 1 of this document. The list of venues is not exhaustive because several locations were unable to accommodate the group of 60 people or were so expensive that we did not pursue further negotiations. In November 2013, the organisers proposed the Sentido Aegean Pearl hotel (http://www.sentidohotels.com/hotels/overview/greece/crete/aegean-pearl/) in Western Crete (Greece) as a venue for TS2014. All members of the SB supported this choice. The main reasons for choosing this location and venue are as follows:

- value for money;
- capacity of a meeting room for at least 60 participants;
- availability of all necessary equipment (projector, laptop, screen, tabletop and wireless microphones, flipcharts) as well as technical support;
- ability to display posters in the meeting room;
- acceptable speed of internet/Wi-Fi in the meeting room;
- ability to organise video-conference if needed;
- frequent scheduled and charter flights to Heraklion or Chania from Athens and/or main European cities
- dealing with a local organiser with whom we have had positive experience from first and second technical schools.

2.2 Registration fees

There were two accommodation options available at Sentido Aegean Pearl hotel for 30 people and at Sentido Pearl Beach hotels for 30 people. Registration costs were set at Euro 845 (Pearl Beach hotel) and Euro 995 (Aegean Pearl hotel). The rates in both Sentido hotels for shared occupancy i.e. either an accompanying person or two people attending the school and sharing a room are given in the Table 1 below.

Table 1. Rates summary

	Rates per person in Sentido Pearl Beach hotel Arrivals 22.06 and departures 28.06.2014	
	Double Occupancy	**Single Occupancy**
Board Basis	FB+	FB+
Total	**655**	**845**
	Rates per person in Sentido Aegean Pearl hotel Arrivals 22.06 and departures 28.06.2014	

	Double Occupancy	Single Occupancy
Board Basis	FB+	FB+
Total	**755**	**995**

The above mentioned rates included:

- 6 overnights at the hotel on full board (FB+) basis (arrivals on 22.06.2014 and departures on 28.06.2014)
- Use of 1 meeting room for the period 23.-27.06.2014 including screen, projector, flip chart, microphones, technician support and poster boards
- 9 private coffee breaks
- 1 welcome reception on a private basis
- Course dinner at the Aegean Pearl hotel on Friday the 27th of June 2014
- Taxes

The TS2014 was not a profit-making event, thus the registration fee paid by each participant was equal to the amount UU pre-paid to the Greek supplier per person to cover the costs of accommodation, all meals, coffee breaks, taxes and a meeting room hire. The cost of the delegate packs and USB drives with teaching materials was covered by the UU budget. The organisers handled payment of the deposit, interim and final balance to the venue, at which the school was held. To recover the costs the UU invoiced each participant attending TS2014. This invoice was for the sum of the accommodation and items shown in Table 1, i.e. 845 or 945 Euro.

2.3 Applications and selection of funded participants

A general application form and an application form for funding support were prepared by UU and were made available on the TS2014 website (http://h2fc.eu/technicalschool). Over the course of the application process, the organisers received a total of 75 general application forms and 28 forms for funding support. Although the closing date was the 1st of April 2014 we continued to accept applications from external, self-paid delegates until mid-May. Because initially we have pre-booked rooms for 60 attendees, additional efforts have been made to contact Sentido hotels as well as nearby hotels, with a view to secure suitable accommodation for all the delegates of TS2014. At a very short notice our local assistant negotiated the rates and booked additional rooms at Pearl Beach hotel, Grekotel Plaza apartments and Dimitros Village hotel for 11 additional attendees. Due to some financial issues and other commitments of 75 applicants, 71 actually attended the TS2014. Several participants required visas to enter Greece. Both the organisers of the school and the local assistant were able to provide those delegates who required visas with formal invitations and letters of support.

According to the DoW, a limited number of external delegates may receive funding to participate in the TS. Funding applicants must be from the organisations outside the H2FC consortium. Preference was given to those applicants who met the following criteria:
1. Applicants must be involved in research and/or education/training activities related to hydrogen and fuel cell technologies and/or infrastructure.
2. Applicants may intend to, or have already applied for facilities access within the H2FC project.
3. The recipients of the funding support were required to present their work at the school.
In addition to the main criteria mentioned above the following was taken into account during the selection process:
- relevance of a presentation topic to the main themes of the TS2014;
- the value of the school to the candidate and of the candidate to the school;

- an equal balance between topics (hydrogen safety; hydrogen storage/production and fuel cells).
- a balance between gender groups (as per DoW more female researchers should be attracted to TS).

In 2014 we have received 28 applications from the applicants seeking funding support (Annex 2). The organisers and the SB have selected five potential recipients of the funding support in the amount of 845 Euro per person (that covered six nights stay at the Pearl Beach hotel on FB+ basis). Also two reserved candidates were selected in case someone cancels his/her participation.

2.4 Announcements

We have used a range of strategies to advertise TS2014 both on European and national level. The first announcement about TS2014 was made in December 2013 via email to partners of H2FC project and SB members. All the information related to the TS2014 including a tentative programme, application forms, rates, travel arrangements etc was made available on the project website on a dedicated page: http://h2fc.eu/technicalschool. This web-page was periodically updated as more information became available. UU partner used its own database of about 8000 email addresses to send multiple announcements.

In January 2014, a promotional flyer was prepared with the aid of UniPG partner (Annex 3). UU had arranged for two announcements to be made in the International Journal of Hydrogen Energy (issue 39/7 and 39/8). Also, it was requested that each H2FC partner circulate the promotional flyer and the web-link to the TS2014 within their network of contacts. Some H2FC partners channelled publicity by targeting relevant departments within their institutions to attract suitable candidates for the school.

2.5 Delegate packs

Partner UU prepared a delegate pack for each participant that consisted of customised H2FC TS zipped folder, H2FC USB with teaching materials, H2FC Transnational access promotional materials, a pen, a notepad, and a name badge. The delegate packs were shipped over to the location of TS2014 in advance of the proceedings. Each participant of TS2014 received the pack during the registration process.

3 Content of TS2014

The structure of the TS2014 was designed in line with the contractual obligations (please see the DoW). The detailed programme of TS2014 is shown in Annex 4 and the full list of the attendees of TS2014 can be found in Annex 5 of the current document.

3.1 Format

The main focus of the TS2014 was to encourage and stimulate the use of H2FC European Infrastructure by external to the project participants.TS2014 lasted one week, starting on Monday, the 23rd of June and finishing on Friday, the 27th of June 2014. Monday and Tuesday were devoted to topical lectures, i.e. to the lectures on topics of primary interest that are essential for the development of the H2FC European Infrastructure as well as to subject lectures delivered by both invited speakers and project partners. First and second days of the school were concluded by panel discussions. In 2014 the number of topical lectures increased to nine. The materials of all lectures were made available to the school participants by placing the lectures slides to the dedicated area of the project website and on USBs provided.

Panel discussion on the first day of TS2014.

Similar to TS2013, students who received funding support from the project and young researchers were able to present the results of their on-going research during a poster session (Tuesday, the 24th of June). To promote discussions and feedback from more experienced scientists posters have been displayed throughout the week. Electronic copies of posters presented were uploaded to the TS 2014 USBs.

The Transnational Access and Instrumentation Workshop was organised on the third day of the school. Partners that provide transnational access (TA) had the exchange of the state-of-the-art in advanced experimental methods and contemporary measurement techniques and the results of TA were also presented by some partners.

Cyber Laboratory session, which addressed scientific bottlenecks through modelling and simulations, took place on the fourth day of the school. It consisted of two expert panels: the first one - on hydrogen safety and the second one - on hydrogen storage and fuel cells, facilitated by leaders in the relevant field. The results presented were aligned with joint research activities within WP10 (Cyber-laboratory). Each modelling sub-session included a number of presentations and concluded by round table discussions. For the first time, participants of TS2014 were able to test H2FC Sage Framework

(http://h2fc.eu/sageserver), especially adjusted to hydrogen and fuel cell models. During Advanced Research Workshop, which was organised on the last, fifth day of the school, the research results generated by H2FC partners, early career researchers and students were reported in a conference style. This session was concluded by round table discussion. The informal discussions between students and tutors also took place during coffee breaks and lunches.

Discussions during Advanced Research Workshop on fifth day of TS2014.

3.2 Speakers and programme

The TS2014 attracted speakers from academia and industry, and thereby provided students with scientific breakthroughs and technological bottlenecks in the fields of hydrogen safety; hydrogen production and/or storage; and fuel cells. The list of tutors at TS2014 is shown in Annex 6. The opening lecture of TS2014 was delivered by Bert de Colvenaer (FCH JU, EC), who highlighted the main achievements and development perspectives in the frame of Horizon 2020. Fuel Cell and Hydrogen Joint Undertaking programme review 2013 supplied by Bert was included in the USBs with school proceedings. An overview of hydrogen and fuel cell technologies in the United States was reflected in the lecture delivered by Jay Keller from the Department of Energy (USA). David Christopher from Tsinghua University (China) had reported on the utilization of hydrogen and fuel cells in China. Technical specificities and market status of hydrogen-powered vehicles were presented by Gerhard Swart from the HySA Systems Integration & Technology Validation Competence Centre (South Africa). Thomas Jordan (KIT partner) spoke about progress and scientific bottlenecks in hydrogen safety. The organiser of the school, Vladimir Molkov chaired the sessions and managed panel discussion on the first day of TS2014.

The second day of TS2014 was also devoted to the topical lectures. It started with the lecture by Tim Mays (University of Bath) on scientific progress and technological bottlenecks in hydrogen storage, followed by the lecture of Franck Verbecke (AREVA) on industrial perspective of hydrogen production and storage. A representative from industry, Guy Dang-Nhu from Air Liquide, spoke about very important topic of regulations, codes and standards for hydrogen and fuel cell systems and infrastructure. The second day was concluded by the lecture 'H2FC European Infrastructure: detailed overview of the transnational activities' made by the coordinator of H2FC project Olaf Jedicke. This is a very critical topic for the project and it was aimed at the external to the project participants with the view to promote and enhance the use of H2FC European Infrastructure facilities. Thomas Jordan and Jay Keller oversaw the compliance with the school agenda and monitored the panel discussion in day two. It is worth mentioning other presentations made during the school. For instance, an

outstanding presentation was made by Anthony Kucernak from Imperial College London on a new reactive gas flux imaging chemiluminescence method applied to polymer electrolyte fuel cell cathodes. Unfortunately due to some work commitments Andreas Züttel from EMPA was not able to present his lecture during topical lecture sessions. To accommodate him the organisers suggested splitting his lecture into two parts 'Storage of hydrogen in solids' and 'Closing cycle with hydrogen', which were embedded in the school programme on the fourth and fifth day. As in previous years these presentations were well received by the participants.

Topical lectures delivered by Thomas Jordan (KIT) and Olaf Jedicke (H2FC coordinator).

Topical lecture on hydrogen storage, speaker Tim Mays.

A hands-on training in using engineering tools was organised on the fourth day of TS2014 within Cyber Laboratory modelling session. Prior to the school the developers of H2FC Sage framework (http://h2fc.eu/sageserver) had asked the participants to familiarize themselves with Sage server and provided necessary access details. James Keenan (UU) had developed several exercises based on real-life scenarios and asked participants to carry out the calculations during the session using Cyber Laboratory engineering tools.

The main objective of the TS2014 was to foster interdisciplinary dialogue around the topics of hydrogen safety, hydrogen storage and production, and fuel cells for representatives from academia, research organisations and industry. This was achieved through the following activities: by selecting and inviting speakers with different perspectives; by preparing high quality lectures; by encouraging students to ask leading experts challenging questions; by stimulating discussions and debates on

relevant topics; by blending presentations from different subjects (safety, storage, fuel cells) within each session. Based on the experience from TS2012 and TS2013, these approaches proved to be efficient in facilitating learning and training of all the participants. Young researchers and students were encouraged to present the results of their on-going research, either via poster or oral presentations, and to discuss them with professionals during TS sessions, coffee breaks and social activities. The work-in-progress poster session, advanced research workshop and informal discussions allowed students and researchers to clarify the terminology used, to familiarise with the state-of-the-art experimental methods, techniques and equipment; to learn innovative engineering tools within Cyber Laboratory; to understand new concepts and modelling approaches in the research area of their interest.

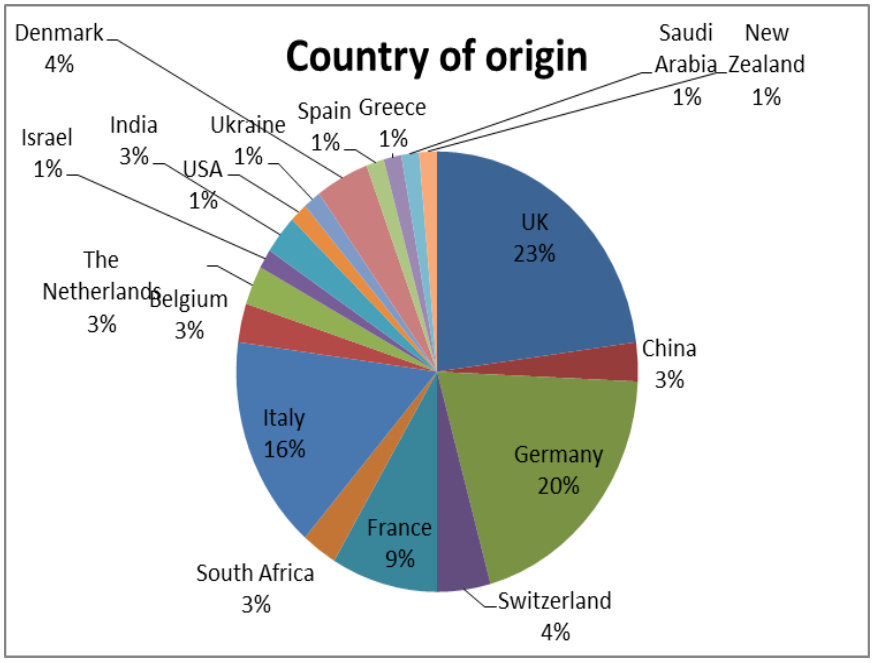
Transnatioanl Acess and InstrumentationWorkshop, third day of TS2014

Overall, during TS 2014 9 topical lectures, 35 oral presentations, 10 posters were delivered. The contents of all sessions were replicated on USB drives and were given to the participants as a part of their delegate pack. Prior to the start of the school the materials from the TS2014 were made available to the participants within the designated area of H2FC website: https://iaikit-sp2.iai.kit.edu/h2fc/TechnicalSchool2014/.

Hands-on training on engineering tools, Cyber Laboratory

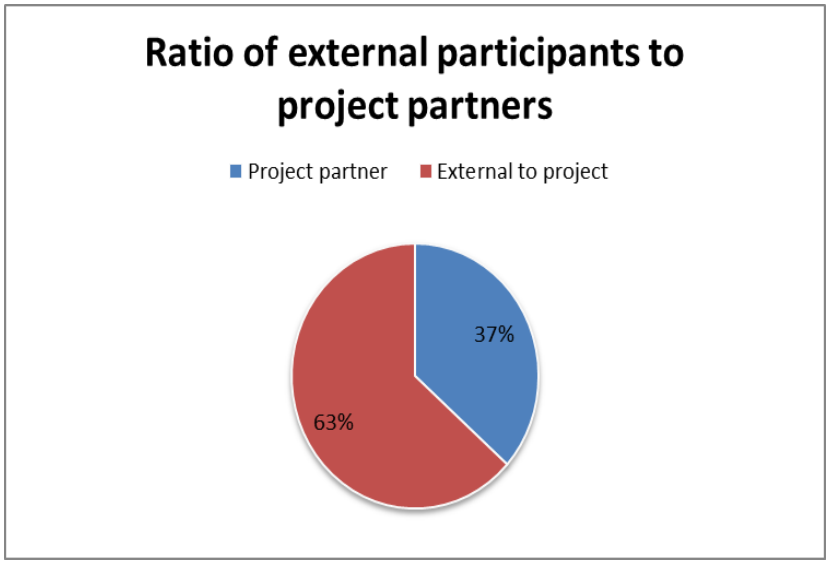
3.3 Participants

In 2014 the technical school gathered 71 participants, the highest number so far compared to the schools held in 2012 (60) and 2013 (59). The participants, including academics, researchers and post-graduate students came from 19 countries around the globe (as opposed to 17 countries at TS2012 and 18 countries at TS2013).



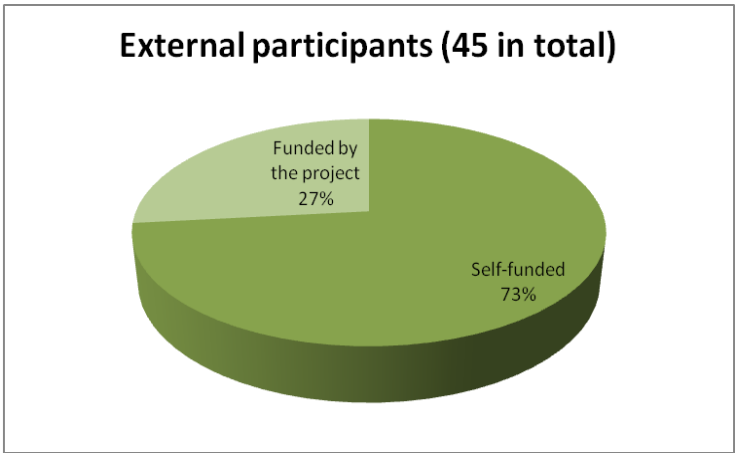
The vast majority of the participants were from the EU states with 14% of attendees from third countries (such as USA, India, China, Israel, Ukraine, New Zealand, the Republic of South Africa and Saudi Arabia).

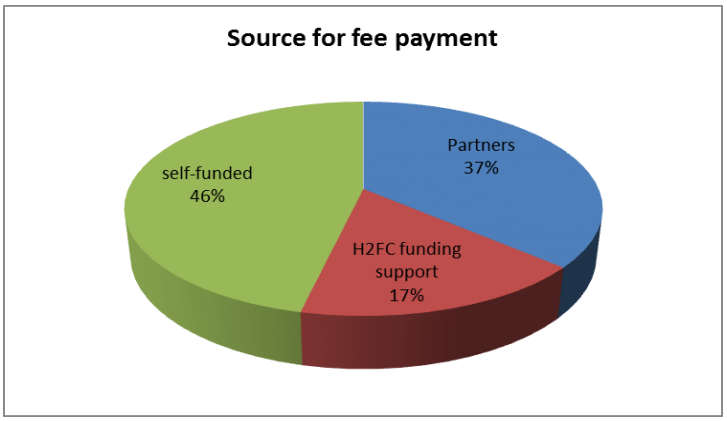
There were 45 participants from outside the project (12 external participants funded by the project, and 33 external, self-funded participants) and 26 participants from H2FC partner organizations. Thus 63% of the participants were external to the project (compared to 38% in TS2012 and 41% at TS2013) and higher than what was promised in the DoW (i.e. 50%).



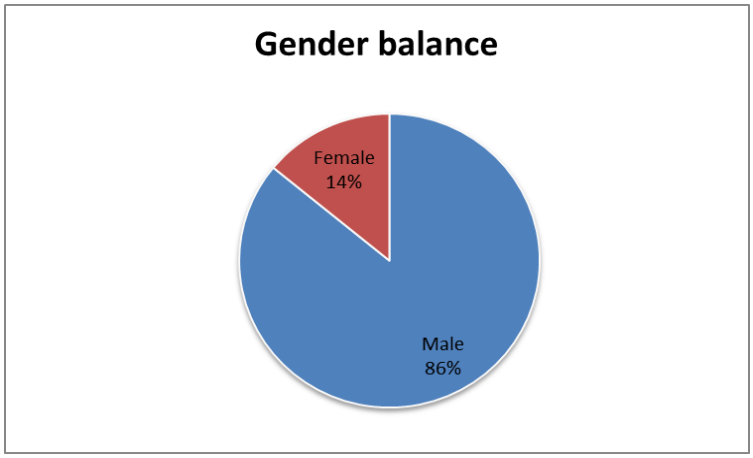
TS2014 participants

The diargam shown below reflects the number of participants (in %) supported financially by the project and the participants who paid the fee from their own budget. It is clear that more than 70% of external attendees had paid the fee from the budgets of the organisations they represented at the school.

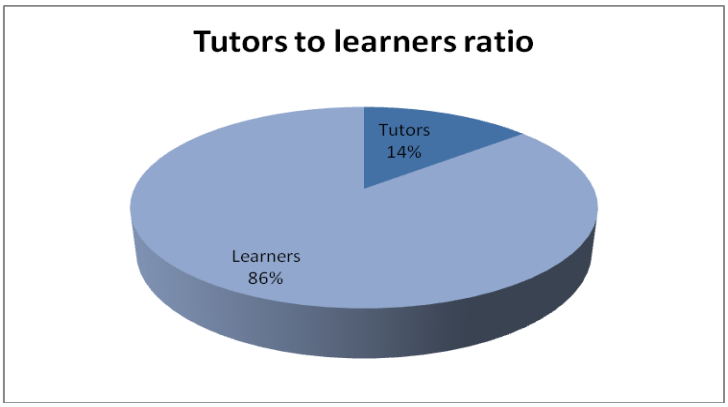




The attendees at TS2014 were 14% female, which is slightly higher than in 2012 (13%) but lower than at TS2013 (16%). The organisers will undertake additional efforts to attract female participants to TS2015.



The ratio of tutors to learners is shown on the diagram below. 86% of all the attendees were learners at TS 2014. The names of the tutors at TS2014 are listed in Annex 6.



The attendance of all sessions was compulsory for the school participants. For the first time we have monitored the attendance on each day of the school and the attendance sheet (Annex 7) indicated the attendance at all sessions was close to 100%.

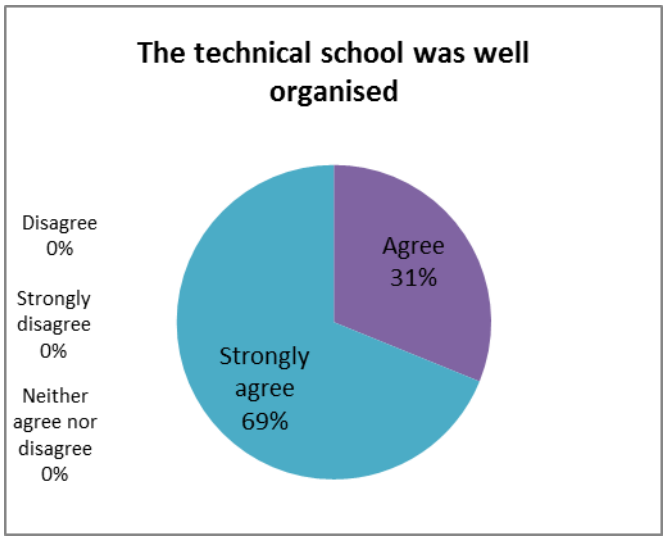
Participants at TS2014 in the auditorium

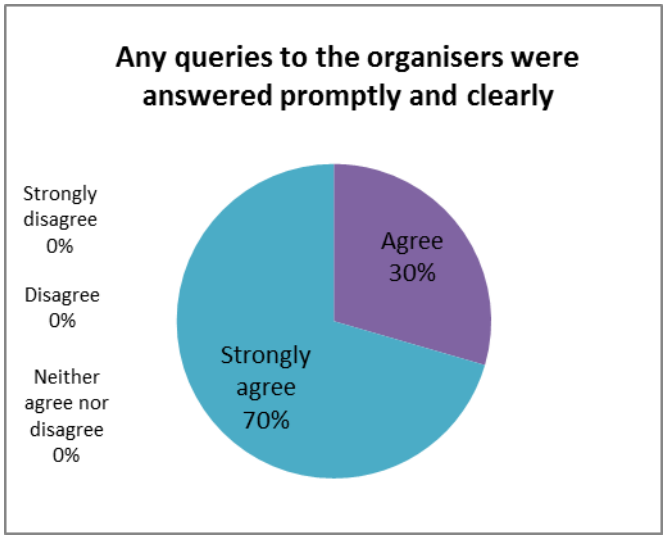
4 Participants feedback

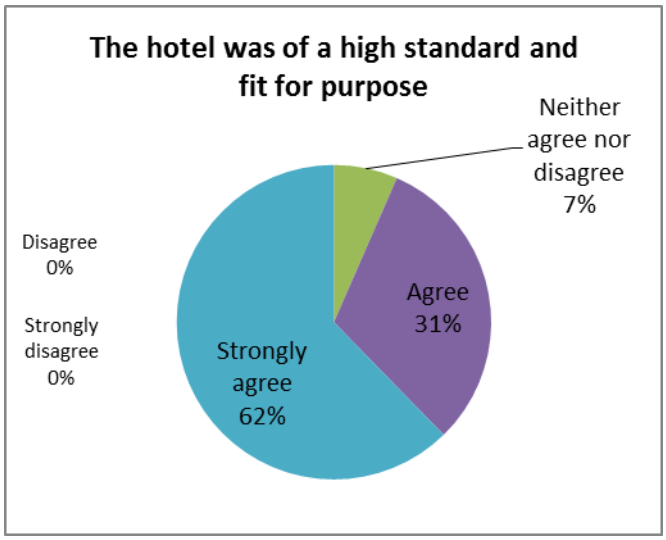
During TS2014 a questionnaire (Annex 8) was given to each participant with the view to gauge their experience of the event. 88% of participants returned completed questionnaires (61 feedback forms were collected in total). Overall the feedback was positive and the main outcomes are summarised below. The TS organisation, programme, speakers, quality of teaching materials as well as the venue were commented on most favourably by the participants.

4.1 Feedback on TS2014 organisation

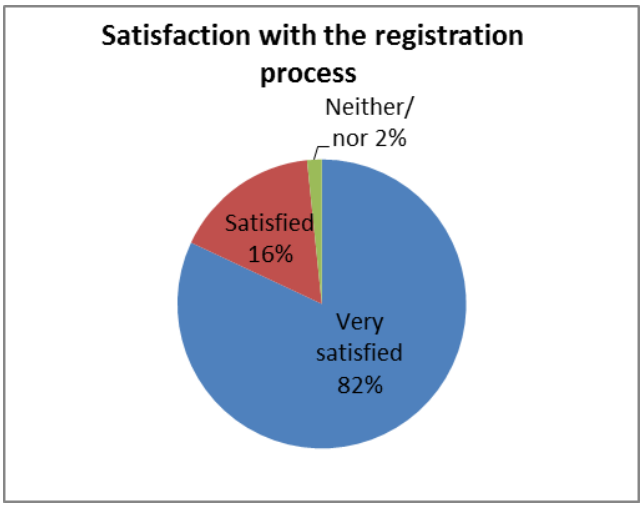
The diagrams below demonstrate the opinions of participants about the level of organisation of TS2014.

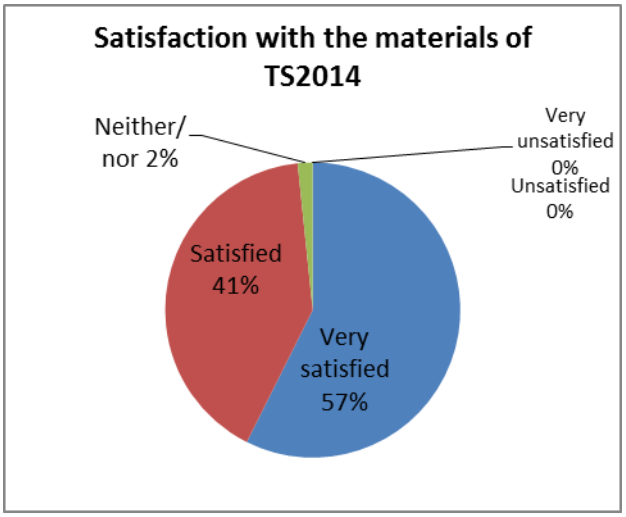


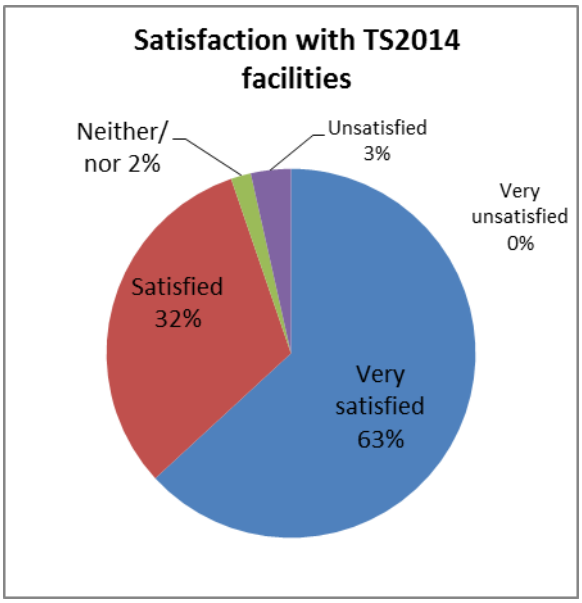




The level of satisfaction among the attendees was very high with many positive comments on excellent organisation of the event, on the engagement of organisers with the participants, on the standard of the chosen hotel and on a support from a local agent.



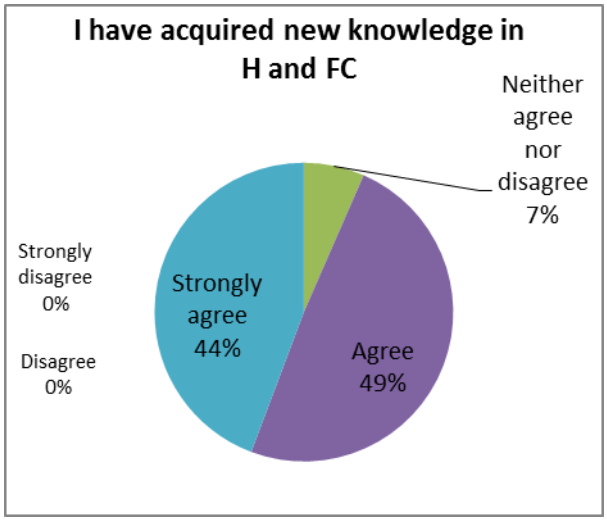




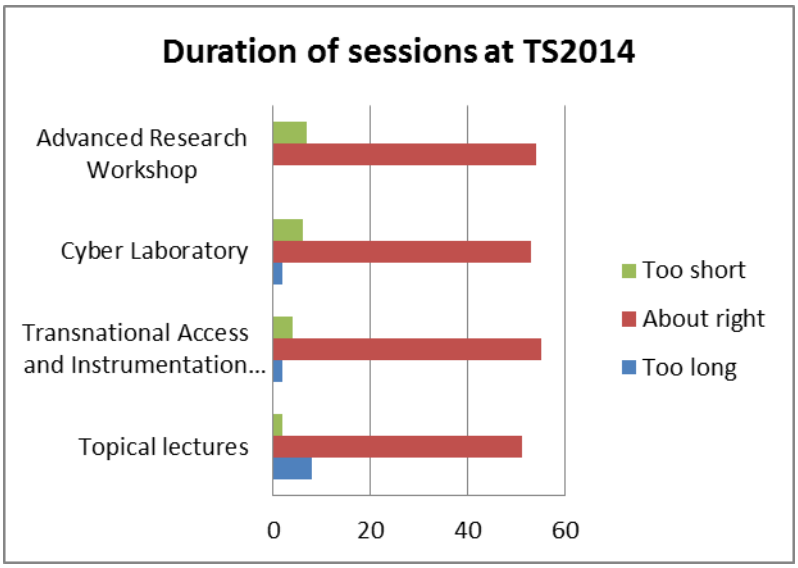
Two people were unsatisfied with the facilities of TS2014. One person did not state the reasons for not being satisfied. The other individual had mentioned that the 'capability to demonstrate movies was not as good' as he/she would have wanted and that 'the quality of a beamer was not perfect'. The organisers should be me thorough in assessing the functionality of the AV equipment before the event.

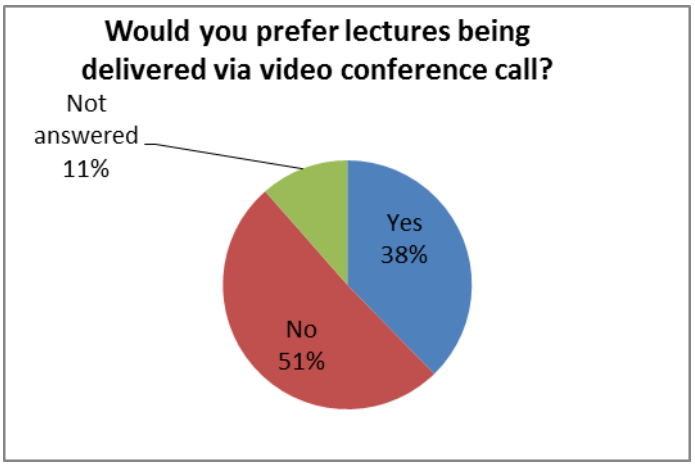
4.2 Feedback on structure, speakers and programme of TS2014

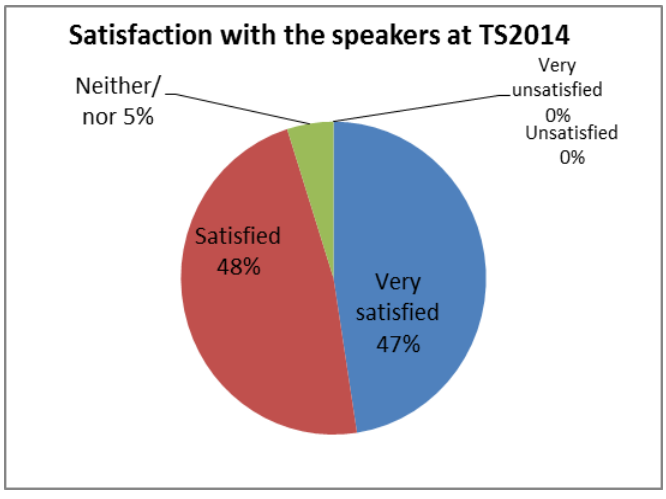
The charts shown below indicate the responses of TS2014 participants with regards to the structure, content, speakers and programme.



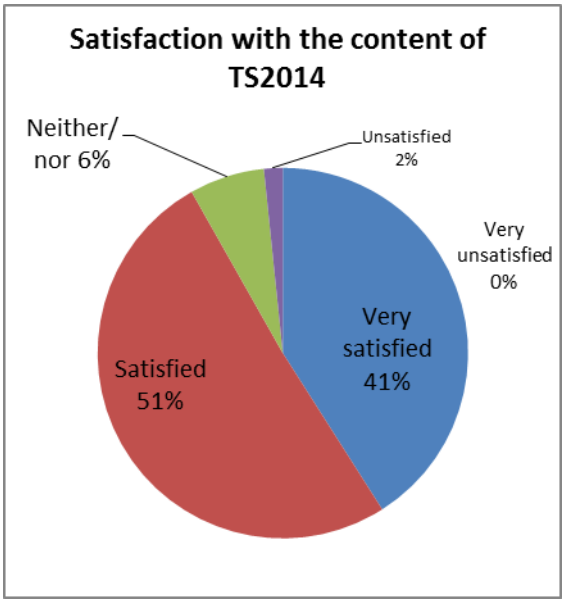
Although the programme and the quality of speakers had received high scores in the feedback some modifications of the school's structure and content were suggested. For instance, 8 people felt that the length of topical lectures can be reduced and at the same time 7 attendees suggested to increase the duration of sessions for Advanced Research Workshop. The organisers will take these comments on board whilst tailoring a programme for TS2015.







As for the content of TS2014, the vast majority of participants were very satisfied (41%) and satisfied (51%) with it (diagram below). Only one person declared being unsatisfied with the content of TS2014 because he/she would have wanted to see more presentations on fuel cells and believed there was a misbalance between three topics. Nevertheless he/she admitted a valuable new knowledge gained in hydrogen safety and storage areas.

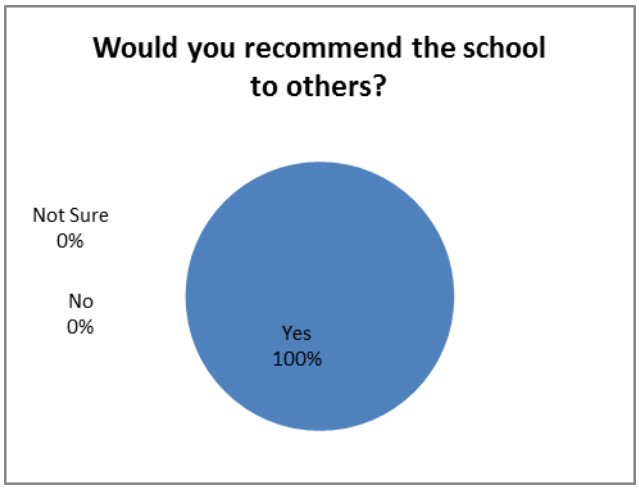


A number of topics of interest were suggested by the participants:

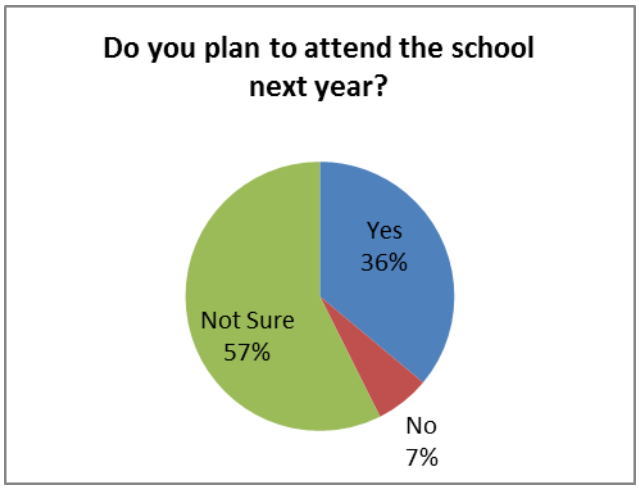
Suggested topic(s)	No of people
1) Fuel cell topics: FC diagnosis; case studies; PEM FC; FC innovative applications; new scenarios for FC; PEM FC degradation; PEM FC testing; light weight FC; hydrodynamic behaviour of FC; HT-SOFC; simulations; SOFC overview (US, Europe etc); overview of FC catalysts; catalysts performance, synthesis, and manufacturing	13
2) Case-studies of practical applications with 'lessons learnt' (eg presentations from car manufacturers, hydrogen bus operating companies)	6
3) Metal hydride compressors and their safety issues; metal hydride storage tanks; how to calculate (chemically controlled) release rate of hydrogen for a particular tanks; how long can metal hydride storage tank can withstand fire and how the release is affected by external fire	5
4) Hydrogen production methods, safety of hydrogen-generating plants	4
5) Safety in laboratories (high pressure cylinders , regulations, certifications etc incidents or near misses)	4
6) Electrolysers	3
7) More practical exercises when participants learn hydrogen (small calculation or modelling task)	2
8) Talks from users of Transnational Access	2
9) Hydrogen storage for non-mobile applications; hydrogen safety in power generation	2
10) Hydrogen separation and purification technologies	2
11) RCS related to high pressure hydrogen storage; refuelling stations	2

4.3 Implications for TS2015 and H2FC project

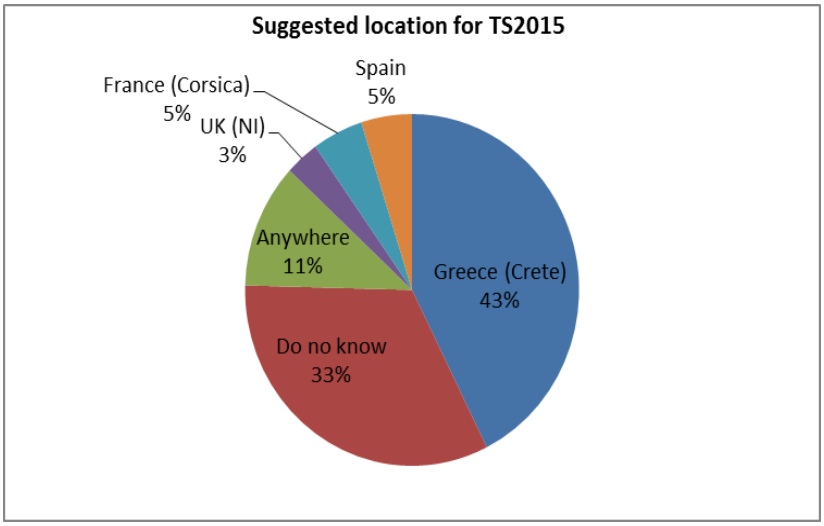
The organisers are very proud that all the participants (100%) will recommend the technical school to other people (colleagues, students, researchers etc). This is very encouraging and positive result for us.



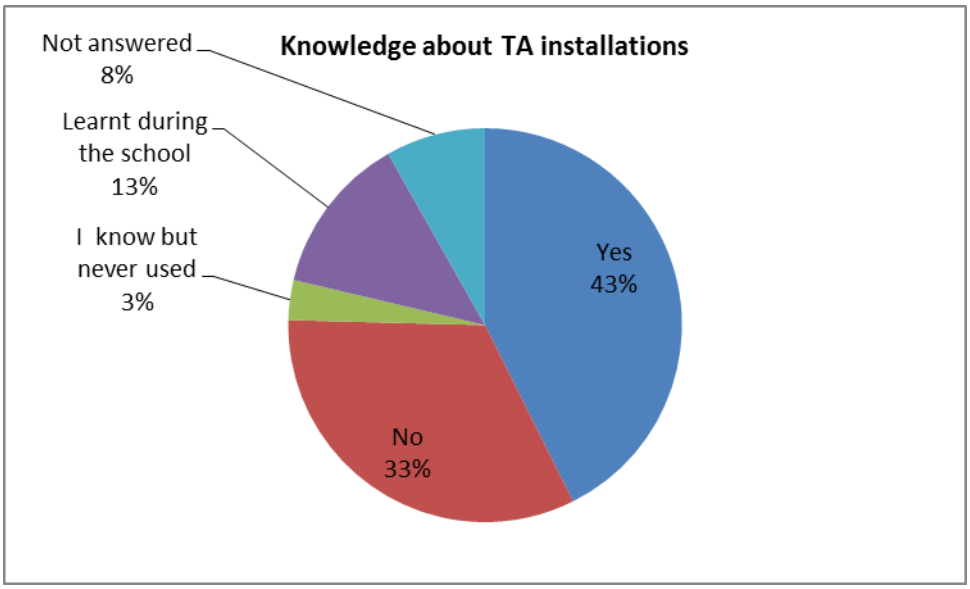
Although 57% of participants were not sure if they will be able to come next year many of them had mentioned that they will attend if the content for TS2015 is not repeated.



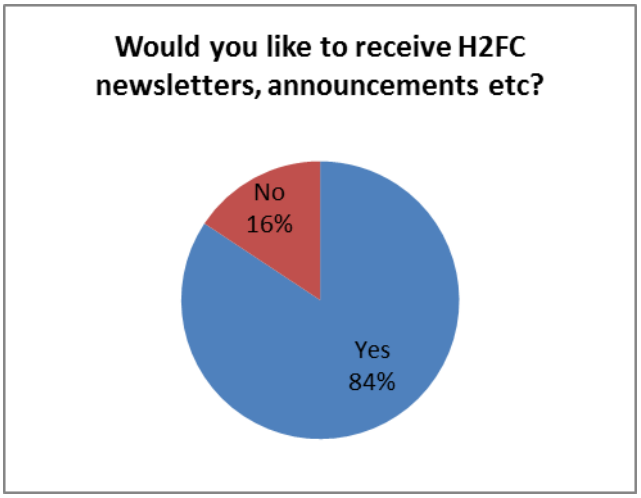
We have also asked the attendees about their preferences in the location of TS2015. The majority of the attendees (43%) voted in favour of Greece; 33% were not sure about the location and 10% preferred other southern European countries.



The charts below indicate that the majority of the participants (43%) are familiar with Transnational Access facilities and installations and 13% learnt about them during the school and are planning to apply.



It is also indicated that 84% of participants would like to receive H2FC newsletters, announcements, calls, project results, benefits etc.



The participants of TS2014 also suggested the following topics for further development of Cyber Laboratory engineering tools and H2FC Sage framework:

Heat flux from hydrogen jets
Links to external worldwide organisations conducting similar research
Local mixture explosion; wind effect on vent levels
Open foam fuel cell model
Explosive mixtures for laboratories (volume, flow rate, safety suggestions)
Sizing of a storage for LH2, metal hydrides etc

4.4 Participants' 'likes and dislikes'

The participants were asked what did they like most/least about the TS2014.

Positive statements:

- Interdisciplinary approach, cross-fertilisation and synergy between topics (18 likes)
- Excellent networking opportunity (15 likes)
- High quality of lectures, presentations and speakers (11 likes)
- Good organisation and time management (8 likes)
- Interesting and fruitful discussions (8 likes)
- Learning opportunities (6 likes)
- Location and venue (6 likes)
- Excellent environment to share information and exchange ideas (5 likes)
- Scientific content (5 likes)
- Opportunity for students to meet experts in the field and discuss issues with them (5 likes)
- Friendly and informal atmosphere (4 likes)
- Cyber Laboratory (2 likes)
- Transnational Access (2 likes)

Dislikes of participants:

- Poor quality of lapel microphone provided by the hotel (4 comments)
- Not enough presentations and lectures on fuel cells (2 comments)
- It was difficult to understand context of some presentations for non-specialists or beginners (2 comments)
- Too far from the airport (2 comments)
- Timing of school clashes with activities for participants from academia (2 comments)
- Absence of case studies and real-life examples (2 comments)
- Misbalance between topics in favour of hydrogen safety (2 comments)
- Absence of practical exercises for students (2 comments)
- Too much focus on automotive applications (2 comments)
- Absence of uniform template for the slides (1 comment)
- Duration of topical lectures was too long (1 comment)

The organisers will try their best to eliminate problems related to the venue, technical structure and programme of TS2015.

4.5 Recommendations for the school improvement

It is clear that there is a room to improve TS further with respect to structure, organisation, facilities and programme. All the comments made by the participants will be critically analysed by the organisers and issues raised will be addressed while planning and running TS2015. The following suggestions from the participants will be accounted for:

- The organisers will supply their own portable microphone rather than rely on the one provided by the venue.
- Ensure that the venue is located closer to the airport
- Ensure that PC and AV equipment is in order
- Change the layout of the desks in the meeting room to provide easier access to electric sockets
- Invite users of transnational access and industrial partners of H2FC project

- Possibly reduce time of topical lectures from 1 hr to 45 minutes
- Include introductory lectures for beginners and practical exercises
- Provide tutors/speakers with a uniform template for presentations
- Instruct tutors and speakers to include introductory sections in their presentations and to avoid being too specific in their topic as the audience of the school is very diverse
- Provide more time for discussions during sessions
- Expand advanced research workshop
- Keep better balance between three main topics
- Engage students in some kind of task or small project during the school that can be evaluated by the experts
- Provide better instructions for those who chair sessions
- Include more overview topics
- Invite potential employer(s) which can be very beneficial for students

4.6 General positive comments from participants

The feedback from TS2014 participants has been overwhelmingly positive with smiles all round. There are some extracts from feedback forms received:

- *" I have attended all three technical schools and they just got better and better: 2012 was good, 2013 even better and 2014 was excellent"* (S. Ledin, HSL)
- *"The school was very well organised in a very interesting venue"*
- *"I thank the organisers for conducting the European Technical school in an excellent manner" (*Sureddy Vishveshwara Naidu, India*)*
- *"A brilliant Technical School! Well done to Ulster for attracting excellent speakers"* (L. O'Sullivan, HSL)
- *"Thank you…for organising the school, what a great technical meeting"*
- *"Very well run and stimulating environment"*
- *"Thank you for providing scholarship for me"* (Tina Su)
- *"Excellent support by local organiser, thank you!"*
- *"Congratulations on pulling off a fantastic event!"*

5 Publicity

In addition to the dissemination activities mentioned in section 2.4 of this document, the organisers gave a number of interviews to Greek media during the school. The video (courtesy of Cretan TV station) can be found on the school website http://h2fc.eu/school14. A report on TS2014 was published in RETHYMNONIOTIKA NEA on the 27th of June 2014. A brief translation from Greek to English was kindly provided to us by the student at the school Ioanna-Viktoria Thanou (Annex 9).

ΔΙΕΘΝΕΣ ΕΠΙΣΤΗΜΟΝΙΚΟ ΣΧΟΛΕΙΟ ΣΤΟ ΡΕΘΥΜΝΟ

Προοπτικές για την αντικατάσταση του πετρελαίου με υδρογόνο

• Πρόκειται για μια οικολογική λύση τονίζουν οι ερευνητές οι οποίοι εμφανίζονται αισιόδοξοι για την επίτευξη του στόχου

27/06/2014 **της Ελπίδας Αριστείδου**

Τις προοπτικές αξιοποίησης του υδρογόνου για την παραγωγή ηλεκτρικής ενέργειας και ειδικότερα την αντικατάσταση του πετρελαίου που χρησιμοποιείται ως καύσιμο στα Ι.Χ. με αυτό εξετάζουν επιστήμονες ανά τον κόσμο. Μετά το πράσινο φως της Ευρωπαϊκής Επιτροπής το θέμα αυτό βρίσκεται σε φάση ερευνητική μιας και η επιστημονική κοινότητα έχει καταλήξει πως πρόκειται για μια λύση οικολογική, που σέβεται πάνω απ' όλα το περιβάλλον, ενώ υπάρχει χρηματοδότηση για το πρόγραμμα αυτό, που σύμφωνα με τους ειδικούς βαδίζει στο σωστό δρόμο και είναι πολλά υποσχόμενο.

Τα ζητήματα αυτά αποτελούν το αντικείμενο του Τεχνικού Εκπαιδευτικού Σχολείου, που πραγματοποιείται στο Ρέθυμνο με συμμετοχή επιστημόνων από όλο τον κόσμο.

Οι συνεδριάσεις έχουν συγκεκριμένα θέματα αυτά της ασφάλειας ως προς τη χρήση υδρογόνου, αποθήκευσή του και τις κυψέλες καυσίμων.

Συμμετέχουν 80 καθηγητές πανεπιστημίων, επιστήμονες και υποψήφιοι διδάκτορες του αντικειμένου προερχόμενοι από τους κλάδους των χημικών μηχανικών, χημικών, μηχανικών ορυκτών πόρων, μηχανολόγων, φυσικών και μαθηματικών - πληροφορικής, προερχόμενοι και από τις πέντε ηπείρους.

«Θεωρούμε τιμή για το Ρέθυμνο να φιλοξενεί αυτό το υψηλότατου επιπέδου συνέδριο σ' ένα θέμα επιστημονικής αιχμής, θέμα που θεωρείται ότι αποτελεί το μέλλον της κάλυψης των ενεργειακών αναγκών του πλανήτη, γι' αυτό εξάλλου και υποστηρίζεται από την Ευρωπαϊκή Επιτροπή» αναφέρεται σε σχετική ανακοίνωση των οργανωτών του συνεδρίου και τα ξενοδοχεία Περλ.

A snapshot from RETHYMNONIOTIKA NEA 27.06.2014

An interview given by Vladimir Molkov (UU, organiser) to Cretan media

6 Conclusions

The third Technical school on Hydrogen and Fuel Cells (TS2014) took place in Rethymnon, Greece between the 23rd and 27th of June 2014. Attracting 71 participants from around the world, TS2014 was themed around hydrogen safety, hydrogen production and storage, and fuel cells as in previous years, 2012 and 2013. TS2014 was organised in full compliance with H2FC DoW and recommendations received from the project officer, taking on board comments from coordinator, school board members and H2FC partners. The goal of TS2014, as per DoW, of creating effective learning and teaching environment for beginners and professionals working (or planning to work) on H2FC Infrastructure facilities was achieved. The new programme, selection of speakers, quality of teaching materials as well as the organisation of TS2014 had received highly positive feedback from the participants.

A comparison of the main statistical indicators for TS2012, TS2013 and TS2014 shows a steady progress. For instance, the total number of participants had grown from 60 at TS2012 and 59 at 2013 to 71 people at TS2014. The number of countries represented at the schools also increased: TS2012 (17), TS2013 (18), and TS2014 (19). In addition, the number of third countries has also risen from 2 at TS2012 and 4 at TS2013 to 8 at TS2014, which is beneficial in terms of visibility of the H2FC project beyond the EU. The international dimension of the event was mentioned by the key-note speaker Prof Tim Mays (UK), who indicated that 'there were representatives from four continents at TS2014'. Most importantly, the number of participants external to the project increased: from 23 at TS2012 and 24 at TS2013 to 45 (63%) external participants in 2014. This is higher than the target of 50% set in DoW. The majority of the external participants (73%) were self-funded delegates. Unfortunately, in 2014 we report a slight drop in female participants, from 16% at TS2013 to 14% at TS2014, although it is still slightly higher than the number of female delegates present at TS 2012 (13%). The organisers and the project partners will attempt to improve this indicator for TS2015. The feedback from the participants indicated that 100% of them will recommend this event to others. Thus, the organisers are very hopeful to gather even higher number of the participants in 2015. The organisers will try to address the issues raised during TS2014 by thorough evaluation of the participants' feedback. It was announced that TS2015 will take place last week in June 2015.

Annex 1. Venue selection (quotes)

Venues comparison: H2FC Technical School 2013
Euro rate (taken 28/11/2013) 1.2
Please note: (1) other hotels in NI and further afield were approached but did not have availability, (2) all prices are in EURO

	Sentido Hotels, Rethymnon	**Clarion Hotel, Carrickfergus**	**Europa Hotel, Belfast**	**Raddisson Blu, Belfast**	**Hotel President, Solin**	**Raddison Blu, Split**	**Hotel Amarilia, Athens**	**Dassia Chandris, Corfu**	**Minoa Palace Resort, Crete**	**Palm Beach Hotel, Cyprus**	**Calabona Hotel, Sardinia**	**Kempinski Palace, Portoroz**	**Grand Hotel Bernardin**	**Sandy Beach Hotel**	**Marina Viva, Corsica**
Country	**Greece**	NI	NI	NI	Croatia	Croatia	Greece	Greece	Greece	Cyprus	Italy	Slovenia	Slovenia	Cyprus	France
Board basis	**Full board/ Package rate**	HB (Breakfast + Lunch)	B&B	B&B	Full board/ Package rate	Full board/ Package rate	Full board	Full board	Full board	All inclusive	Full board	Breakfast incl in rate,lunch incl in meeting room fee	Half board (breakfast + dinner); lunch 15 EUR per day	All inclusive	Full board package
Rate p/n single room	**included**	£100 = E120	£90*1.2 = E108	£119 = E142.8	included	included	125	158	158	175	165.8	205	119	185	157
Rate p/n double room		?	£110	?	?	?	148.5	175	175	285	264.1	225	99	295	268
Meeting room 5 days	**included**	included	£1600 p/d = E9600 total, E160 PP	£29 pd = E174 pp pw	included	included	Free	Free	Free	Free	3,400	61 pp pd est. 18300	2,000	1,250	included
Poster stands 5 days	**included**	?		?	included	included	750	Free	Free	Free	300	N/A	Free	Free	?
Coffee breaks (10) per person	**included**	included	£40 = E48	Incl in meeting rate	included	included	65	85	85	105	included in room rate	included in a meeting room rate	55	95	included
Lunches	**included**	included	£15 pp pd = E90	Incl in meeting rate	included	included	included	included	included	included	included	included	extra (see above)	included	included
Dinners	**included**	est £25 excl drinks = E150 pp pw	£30 pp pd = E180 pw	£20 pp excl drinks = E120 pp p/w	included	included	included	included	included	included	included	Additional cost	included	included	included
Private welcome reception per person	**included**	?	?		included	included	included	included	included	12.5	included	additional cost	additional cost	10.5	?

Private farewell dinner per person	**included**	30	£36 is min with 1 drink = E43.2	£30 exc drinks = E36 min	included	included	45	68.5	68.5	45	15	90		65	estimate E50 based on previous
Wi-Fi	**included**	included	?	Incl in meeting rate	included	included	Free	Free	?	?	Free	Free	Free	free	NOT AVAILABLE THROUGHOUT
Total for single accommodation for 6 nights	**Package rate**	720	648	714	Package rate	Package rate	860	948	948	1050	995	1,230	714	1,110	942
Cost per person = 6 days	**30 rooms at each = 839.50 and 989.50, average cost pp = €914.50 ALL INCLUDED**	€900 excluding excursion	€1229.2 exl welcome reception, drinks and excursion	€1044 excl excursion, reception and drinks	€1329 for package	€1329 for package	€875 + excursion	€1101.5 + excursion	€1101.5 + excursion	€1212.5 + excursion	€1124	€1631 + welcome + excursion	€890 + welcome + excursion	€1305.5 + excursion	€992 excl excursion and welcome reception
OTHER INFLUENCING FACTORS															
All activities coordinated via one local English speaking operator	**Past experience with operator and positive feedback on this**	y	y	y	No	n	y	y	y	y	n	n	n	n	n, issue in the past, English speaker not always available
Drive from the airport	**50 mins +**	30 mins	30 mins	30 mins	2-3 hrs	2-3 hrs	30 mins	20 mins	30 mins	20 mins	7 km	80 km but limited carriers, realistically 2+ hrs	90 km but limited carriers, realistically 2+hrs	20 mins	20 mins
Additional comments		Rate is attractive but partners have indicated preference	No drinks included with meals	No drinks included with meals			small hotel, restricted availibility	Limited availability	only 50 spaces		Would not prepare contract to fix				Previous experience with

		for elsewhere									rates				venue is pro
Decision	**YES**	No	No	No	No	no	No	No	No	No	No	No	No	No	No
Reason	**Cheapest, everything included, good standard accommodation, previous experience with operator, all organised via one group**	Good rate but lower standard and less included than other options e.g. preferred choice includes more at 14E difference	Cost + Feedback from project partners	Cost + Feedback from project partners	Hard to reach	Hard to reach +cost	Very poor feedback	Cost, limited availability	restricted availability	Cost	Cost & unwilling to prepare contract	Cost, and airport not accessible	airport not accessible	Cost	Wifl is a priority based on feedback, English

Annex 2. Selection of candidates for funding support

Name	Country of origin/Nationality	Gender	Organisation and position	Scientific area	Date of application	Title of poster/presentation	Applied for/planning to apply H2FC Access facilities	Previous funding support	Recipient of funding support in 2014 (Y/N)
Shani Elitzur	**Israel/ Israeli**	**Female**	**Technion - Israel Institute of Technology, PhD student, http://youtu.be/IBbPL_c0mks**	**H production and FC**	**12-01-14**	**Experimental investigation of hydrogen generation via aluminium-water reaction and energy production and storage using PEM fuel cells**	**No**	**No**	**Y**
Tina Su	**UK/New Zealand**	**Female**	**School of Chemistry, University of Glasgow, PhD student**	**H storage**	**12-02-14**	**Solid state modular hydrogen fuel using LiH and urea**	**No**	**No**	**Y**
Thomas Lamberti	**Italy/Italian**	**Male**	**University of Genoa, Thermochemical Power Group, PhD student**	**FC**	**29-01-14**	**Maritime application of PEM fuel cell**	**No**	**No**	**Y**
Basamat Shaheen	**Egypt/Egyptian**	**Female**	**The American University in Cairo, PhD student**	**H production**	**21-12-13**	**Niobium Oxide Photoanodes for Hydrogen Production from Solar - Water Splitting**	**No**	**No**	**Y**
Maxim Bragin	**UK/British**	**Male**	**Loughborough University, early career researcher?**	**H safety**	**17-01-14**	**Large-Eddy simulation of a hydrogen-air flames passing through a set of obstacles**	**No**	**No**	**Y**
Francesco Valle	Italy/Italian	Male	Università degli Studi di Trieste, PhD student	FC	24-02-14	PEM FC degradation study through catalyst layer SAXS nano-morphology mapping	No	No	**1st reserve**
Ali Heidari	UK/British	Male	Kingston University London, Lecturer	H safety	22-02-14	Flame acceleration and transition from deflagration to detonation in H explosion	No	Yes (2012)	**2nd reserve**
Ahmad Mohyeldin Mohamed	Egypt/Egyptian	Male	The American University in Cairo, MSc Student	H production	21-12-13	Graphene Quantum dots for enhanced solar absorption in water splitting applications.	No	No	No
Ahmad Waleed Amer	Egypt/Egyptian	Male	The American University in Cairo, MSc student	H production	21-12-13	No title offered	No	No	No
Amir Reza Fahami	Italy/ Iranian	Male	Laboratory of Catalysis and Catalytic Processes, Dipartimento di Energia, Politecnico di Milano, PhD student	H production	22-01-14	Refused to give a poster	No	No	No
Robert Gloukhovski	Israel/Israeli	Male	Dept of Chemical Engineering Technion - Israel Institute of Technology, PhD student	FC	24-12-13	A novel composite proton exchange membrane for PEM FC and water electrolysis	No	No	No
Yael Binyami	Israel/Israeli	Female	Technion - Israel Institute of Technology, MSc student	FC	25-12-13	Implementation of impedance spectroscopy genetic programming on PEM fuel cells	No	No	No

Konstantin Volkov	UK/British	Male	Kingston University London, Lecturer	H safety	02-01-14	CFD developments and simulations of reactive flows in H safety engineering	Yes	Yes (2012 and 2013)	No
Qiong Cai	UK/Chinese	Female	Department of Chemical and Process Engineering Faculty of Engineering and Physical Sciences University of Surrey, Lecturer	FC modelling	15-01-14	Modelling and optimal control study of hydrogen production when electrolysers work with intermittent renewables	No	No	No
Behzad Najafi	Italy/ Iranian	Male	MRT Fuel cell lab of Politecnico di Milano, PhD student	FC	20-01-14	Sensitivity analysis on the effect of operating parameters on the long term performance of a residential micro CHP system based on HT-PEM fuel cell considering the degradation effects	No	No	No
Mehrzad Shams	Iran/Iranian	Male	Faculty of Mechanical Engineering K.N.Toosi University of Tech., Associate Associate Professor	FC modelling	20-01-14	Mathematical and experimental analysis of floading in PEM FC	No	No	No
Venera Giurcan	Romania/Romanian	Female	Institute of Physical Chemistry, Researcher	H safety?	21-01-14	Propagation parameters of gaseous hydrocarbon-air explosions in enclosures	No	No	No
Lorenz Bock	Germany/German	Male	Institute for Thermodynamics, TUM, PhD student	H safety	03-02-14	Highly time resolved OH PLIF of deflagrations in H2-air mixtures	No	Yes (2013)	No
Aditya Maheshwari	Germany/Indian	Male	University of Muenster, PhD student	Not involved in H related activities	11-02-14	Carbonate-mixed oxide composite electrolytes: an enhanced total conductivity	No	No	No
Mohamed Barbouche	Tunisia/Tunisian	Male	CRTen, Engineer (FC)	FC	12-02-14	Piloting of a FC test station	No	No	No
Bruno Salque	France	Male	CEA-external, PhD student	H storage	03-03-14	Measure of the hydride breathing stress induced by cyclically absorbing and desorbing H	No	No	No
James Sampson	UK	Male	Technical Curriculum Manager, Zero Carbon Futures, Gateshead College	education	12-03-14	Hydrogen in the community	No	No	No
Yaxiang Lu	UK/China	Female	University of Birmingham	FC	12-03-14	Temperature-controlled growth of Pt nanowires for high performance catalyst electrodes in polymer electrolyte fuel cells	No	No	No
Codina Movileanau	Romania	Female	Institute of Physical Chemistry, Researcher	safety	28-03-14	Experimental investigation of flame propagation in gaseous air-fuel mixtures	No	No	No
Carlos Herce	Spain	Male	University of Zaragoza, Young researcher	safety	21-03-14	CFD modelling of a semi-industrial sorption enhanced steam methane reforming	No	No	No
Marco Bellini	Italy	Male	National Council of Research of Florence (Italy) - Organometallic Compounds Institute,	FC	27-03-14	Platinum free electrocatalysts for H2/O2 Alkaline Membrane Fuel Cells (AMFC)	No	No	No

			PhD student						
Elitsa Petkucheva	Bulgaria	Female	Bulgarian Academy of Science, PhD student	H production	28-03-14	Hydrogen production via electrolysis based on titanium oxide supported catalysts	No	No	No
Iveta Boshnakova	Bulgaria	Female	Bulgarian Academy of Science, PhD student	H production	28-03-14	Catalytic activity of IrFe disperssed on Titanium oxide supports toward OER in PEMWE hydrogen generation	No	No	No

Annex 3. A promotional flyer for TS2014

EUROPEAN TECHNICAL SCHOOL ON HYDROGEN AND FUEL CELLS

2014

The H2FC project is funded by the European Commission. The school is organised by the project partners and coordinated by the University of Ulster

The sessions at the School address the themes of hydrogen safety, storage and fuel cells.

Presentations will include details on research methods and instrumentation related to the state-of-the-art experimental facilities offering access within the H2FC project.

Topical lectures and discussions on modelling and CFD are also included.

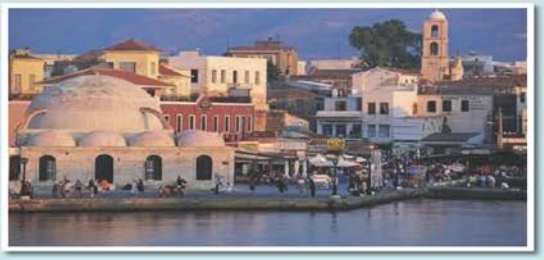
23 / 27
JUNE 2014
CRETE, GREECE

Sentido Hotels
Rethymnon - Crete - Greece

995 Euro *for Aegean Pearl Hotel*

845 Euro *for Pearl Beach Hotel*

Accommodation options are available on a first come first served basis. In each case the fee covers six nights (Sunday 22–Saturday 28) accommodation on a single occupancy, full board basis (i.e. all meals and local beverages are included with meals).
Attendees may check in from 15:00 on Sunday the 22nd and must check out by 12:00 on Saturday the 28th of June 2014. The fee also includes attendance at all sessions, an electronic copy of course materials, a welcome reception, private coffee breaks, an excursion and attendance at the course dinner.



HOW TO APPLY FOR THE TECHNICAL SCHOOL

All participants must complete the registration form available at **http://www.h2fc.eu/technicalschool** and return it to Dr Svetlana Tretsiakova-McNally **(s.tretsiakova-mcnally@ulster.ac.uk** or **H2FCTechnicalSchool@ulster.ac.uk).**

PLEASE SUBMIT YOUR REGISTRATION FORM AS SOON AS POSSIBLE! PLACES ARE LIMITED!

IMPORTANT

A limited number of applicants will be selected to receive funding; this funding covers the course fee only and not travel costs.
Funding applicants must be from organisations outside the H2FC consortium. Please find instructions on how to apply for the school funding at **http://www.h2fc.eu/technicalschool**

H2FCtechnicalschool@ulster.ac.uk • Alternatively contact: Dr Svetlana Tretsiakova-McNally, Lecturer, Hydrogen Safety Engineering and Research Centre (HySAFER), Block 27, Faculty of Art, Design and the Built Environment, University of Ulster, BT37 0QB, Northern Ireland, UK.
Phone: +44(0)2890366073 • Email: s.tretsiakova-mcnally@ulster.ac.uk• http://www.h2fc.eu/technicalschool

Annex 4. Programme of TS2014

Sunday, 22 June 2014

After 15:00	Arrival of participants (check-in after 15:00)
19:00-20:00	Registration
20:00-22:00	Dinner

Monday, 23 June 2014
Topical Lectures
Topical lectures on the key themes: safety, storage and fuel cells

08:50-09:20	Registration
09:20-09:30	**Opening of the Technical School 2014** Vladimir Molkov, Svetlana Tretsiakova-McNally, UU (UK)
09:30-10:30	**Main achievements and development perspectives in the frame of Horizon 2020** Bert de Colvenaer, The Fuel Cells and Hydrogen Joint Undertaking, European Commission (Belgium)
10:30-11:30	**Hydrogen and fuel cell technologies: overview** Jay Keller, DoE (USA)
11:30-11:50	*Coffee and networking around posters*
11:50-12:50	**China hydrogen and fuel cell utilization** David Christopher, Tsinghua University (China)
12:50-14:10	*Lunch*
14:10-15:10	**Hydrogen-fuelled vehicles: technical and market status** Gerhard Swart, HySA (Republic of South Africa)
15:10-15:30	*Coffee and networking around posters*
15:30-16:30	**Progress and bottlenecks in hydrogen safety** Thomas Jordan, KIT (Germany)
16:30-17:00	**Panel discussion**
19:00-20:00	Welcome reception and get together evening

Tuesday, 24 June 2014
Topical Lectures
Topical lectures on the key themes: safety, storage and fuel cells

10:00-11:00	**Scientific progress and technological bottlenecks in hydrogen storage** Tim Mays, University of Bath (UK)
11:00-11:20	*Posters and coffee break**
11:20-12:20	**Safety of hydrogen and fuel cell technologies: industrial research perspective** Franck Verbecke, Areva (France)
12:20-13:50	*Lunch*
13:50-14:50	**Progress in RCS for hydrogen and fuel cell systems and infrastructure** Guy Dang-Nhu, Air Liquide (France)
14:50-15:30	*Posters and coffee break**
15:30-16:30	**H2FC European Infrastructure: detailed overview of the Transnational Access activities** Olaf Jedicke, KIT (Germany)
16:30-17:00	**Panel discussion**

*Note: posters will be displayed throughout the week; on the 24th June the authors are required to be present at their posters to answer questions

Wednesday, 25 June 2014

Transnational Access and Instrumentation Workshop

This workshop concentrates on recent advances in the research techniques and methods and results of Transnational Access.

09:30-09:50	**Experimental studies of plume dispersion** Gilles Bernard-Michel, CEA (France)
09:50-10:10	**Towards a more representative corrosion test method for metallic PEFC bipolar plates** Gareth Hinds, NPL (UK)
10:10-10:30	**Overview of engineering tools for Cyber Laboratory** James Keenan, UU (UK); Klaus Bittner, KIT (Germany); Manuelle Quinaud, CEA (France)
10:30-10:50	**Imaging and quantifying water in fuel cells with neutrons: latest methodological improvements** Johannes Biesdorf, PSI (Switzerland)
10:50-11:10	*Coffee and networking around posters*
11:10-11:30	**Transnational Access at KIT-HYKA** Andreas Friedrich, PS (Germany)
11:30-11:50	**Improved high-power test rig facility** Izaak Vinke, Jülich (Germany)
11:50-12:10	**Sensors for hydrogen and hydrogen application related quantities** Mark Bader, BAM (Germany)
12:10-12:30	**Experiments on vented deflagration and hydrogen safety of indoor facilities** Mikhail Kuznetsov, KIT (Germany)
12:30-14:00	*Lunch*
14:00-14:20	**Concentration measurement methods for LH2 (Liquid Hydrogen) pools and vapour** Louise O'Sullivan, HSL (UK)
14:20-14:40	**A new reactive gas flux imaging method based on chemiluminescence: a first application to polymer electrolyte fuel cell cathodes** Anthony Kucernak, Imperial College (UK)
14:40-15:00	**Scientific methodology improvement from access results at University of Perugia.** Gabriele Discepoli, UniPG (Italy)
15:00-15:20	**Characterisation of intumescent behaviour of fire protective coating for type 4 tanks** Paul Joseph, UU (UK)
15:20-15:40	*Coffee and networking around posters*
15:40-16:00	**Enabling low-cost fuel cell deployment: characterization of key components in high-temperature fuel cell systems** Stephen McPhail, ENEA (Italy)
16:00-16:20	**Effect of intumescent paint on fire resistance of on-board storage** Jean Meyer, PhD student (Germany)
16:20-16:50	**Round table discussion on instrumentation and transnational access**

Thursday, 26 June 2014

Cyber Laboratory: addressing scientific bottlenecks through modelling and simulations

Expert Panel on Hydrogen Safety. Moderator: Dmitriy Makarov

09:45-10:10	**Development of a pseudo source approach for plane jets** Stefan Ledin, HSL (UK)
10:10-10:35	**Simulations of detonations** Alexei Kotchourko, KIT (Germany)
10:35-11:00	**Development of model evaluation protocol for hydrogen and fuel cell safety analysis: the progress of SUSANA project,** Boris Chernyavskiy, UU (UK)
11:00-11:20	*Coffee and networking around posters*
11:20-11:50	**Hands-on training of engineering tools for Cyber Laboratory** James Keenan, UU (UK); Klaus Bittner, KIT (Germany); Manuelle Quinaud, CEA (France)
11:50-12:05	**Round table discussion on modelling and simulations as a part of research infrastructure**

Expert Panel on Hydrogen Storage and Fuel Cells. Moderator: Manuelle Quinaud

12:05-12:30	**Storage of hydrogen in solids** Andreas Züttel, EMPA (Switzerland)
12:30-14:00	*Lunch*
14:00-14:25	**Thermally coupled hydrogen storage - fuel cell systems**

	Andreas Yiotis, NCSRD (Greece)
14:25-14:50	**Non-linear control for fuel cell system: from simulation to rapid prototyping** Manuelle Quinaud, CEA (France)
14:50-15:15	**Experimental test of innovative sorbents based on calcium aluminates for SE-SR** Gabriele Discepoli, UniPG (Italy)
15:15-15:35	*Coffee and networking around posters*
15:35-16:00	**Study of water behavior within a PEMFC (modeling and experimental approaches)** Manuelle Quinaud, CEA (France)
16:00-16:25	**Modelling-based design of a hydrogen storage tank for a heavy duty vehicle** Albin Chaise, CEA (France)
16:25-17:00	**Round table discussion on modelling and simulations as a part of research infrastructure**

Friday, 27 June 2014
Advanced Research Workshop

09:45-10:10	**Hydrogen powered transport: safety issues and future safety strategies** Vladimir Molkov, UU (UK)
10:10-10:35	**Evaluation of hydrogen embrittlement measurement: SSRT and electrochemical hydrogen load** JB Jorcin, Tecnalia (Spain)
10:35-11:00	**Numerical analysis of hydrogen safety issues** Daniele Melideo, JRC (The Netherlands)
11:00-11:20	*Coffee and networking around posters*
11:20-11:45	**Passive ventilation to control hydrogen released into enclosures** Stuart Hawksworth, HSL (UK)
11:45-12:10	**Prediction of overpressure during vented deflagrations of localized mixtures** Dmitriy Makarov, UU (UK)
12:10-12:35	**Closing the cycle with hydrogen** Andreas Züttel, EMPA (Switzerland)
12:35-14:05	*Lunch*
14:05-14:30	**3D thermomechanical modelling in fuel cell systems** Murat Peksen, Jülich (Germany)
14:30-14:55	**The MgH_2-$Mg(OH)_2$ system as a cheap, pioneering hydrogen store** Laura Bravo-Diaz, JRC (The Netherlands)
14:55-15:20	**Large-Eddy Simulation of a premixed hydrogen-air flames passing through a set of obstacles** Maxim Bragin, Loughborough University (UK)
15:20-15:40	*Coffee and networking*
15:40-16:05	**Modelling and numerical simulation of sonic jet release and dispersion in passively vented room-like enclosure,** Boris Chernyavskiy, UU (UK)
16:05-16:30	**Numerical simulation of bare hydrogen storage tank performance in bonfire** Sergii Kashkarov, PhD student (Ukraine)
16:30-16:55	**Development of safety standard for mobile hydrogen refuelling facilities in China** Li Zhiyong, Tongji University (China)
16:55-17:15	**Round table discussion and close of the School**
20:00-22:00	Gala dinner at the hotel

Saturday, 28 June 2014

Before 12:00	**Departure of participants (Latest check-out time for all participants is 12:00)**

POSTER SESSION
Tuesday, 24th June 2014

1. **Experimental investigation of hydrogen generation via aluminum-water reaction and energy production and storage using PEM Fuel Cells**, Shani Elitzur, Israel Institute of Technology (Israel).

2. **PEM Fuel Cells degradation study through catalyst layer SAXS nano-morphology mapping,** Francesco Valle, Università degli Studi di Trieste (Italy).

3. **Maritime application of PEM fuel cell,** Thomas Lamberti, University of Genoa, (Italy).

4. **Solid state modular hydrogen fuel using LiH and boric acid**, Tina Yu-Ting Su, University of Glasgow (New Zealand).

5. **Reduced order model of Solid Oxide Electrolysis Cell**, Jarosław Milewski, Warsaw University of Technology (Poland).

6. **Effects of thin-film Pd deposition on the hydrogen permeability of Pd60Cu40 membranes**, Naser Al-Mufachi, University of Birmingham (UK).

7. **Platinum free electrocatalysts for H2lO2 Alkaline Membrane Fuel Cells (AMFC**), Marco Bellini, lstituto di Chimica dei Composti Organometallici (Italy).

8. **Initial performance analysis of a methanol steam reformer**, Kristian Kjær Justesen, Aalborg University (Denmark).

9. **Our hydrogen community: vision**, James Sampson, Zero Carbon Futures (UK).

10. **Experimental techniques for the measurement of liquid hydrogen (LH2) and experimental phenomena**, Louise O'Sullivan, HSL (UK).

Annex 5. Attendees of TS2014

	Surname	First Name	Company	Email address	Country
1	Agnello	Giuseppe	C.N.R. I.T.A.E. (E)	agnello@itae.cnr.it	Italy
2	Al-Mufachi	Naser	University of Birmingham (E)	NAA037@student.bham.ac.uk	UK
3	Arista	Alessandro	C.N.R. I.T.A.E. (E)	arista@itae.cnr.it	Italy
4	Astier-Perret	Robin	Toyota Motor Europe (E)	Robin.Astier-perret@toyota-europe.com	Belgium
5	Bader	Mark	BAM (P)	Mark-Andreas.Bader@bam.de	Germany
6	Balland	Sarah	MBDA France SAS (E)	sarah.balland@mbda-systems.com	France
7	Bellini	Marco	National Council of Research of Florence (E)	mbellini@iccom.cnr.it	Italy
8	Bernard-Michel	Gilles	CEA (E)	gilles.bernard-michel@cea.fr	France
9	Biesdorf	Johannes	PSI (P)	Johannes.Biesdorf@psi.ch	Switzerland
10	Bittner	Klaus	KIT (P)	klaus.bittner@kit.edu	Germany
11	Bragin	Maxim	Loughborough University (E-f)	M.Bragin@lboro.ac.uk	UK
12	Brauer	Andre	Airbus Operations GmbH (E)	andre.brauer@airbus.com	Germany
13	Braun	Waldemar	Jülich (E)	wa.braun@fz-juelich.de	Germany
14	Bravo-Diaz	Laura	JRC (P)	Laura.BRAVO-DIAZ@ec.europa.eu	The Netherlands
15	Chaise	Albin	CEA (E)	albin.chaise@cea.fr	France
16	Chernyavskiy	Boris	UU (E)	b.chernyavskiy@ulster.ac.uk	UK
17	Chitti Babu	Nalluri	Andhra University (E)	nallurichitti@rediffmail.com	India
18	Christopher	David	Tsinghua University (E-f)	dmc@tsinghua.edu.cn	China
19	Dang-Nhu	Guy	Air Liquide (E-f)	Guy.DANG-NHU@airliquide.com	France
20	De Colvenaer	Bert	FCH-JU (E-f)	Bert.De.Colvenaer@fch.europa.eu	Belgium
21	Discepoli	Gabriele	UP (P)	gabriele.discepoli@unipg.it	Italy
22	Elitzur	Shani	Israel Institute of Technology (E-f)	elitzur.shani@gmail.com	Israel
23	Erfurt	Viktoria	Jülich (E)	v.erfurt@fz-juelich.de	Germany
24	Foresti	Stefano	Politecnico di Milano (E)	steforrest@hotmail.it	Italy
25	Friedrich	Andreas	Pro-Science (P)(SB)	andreas.friedrich@partner.kit.edu	Germany
26	Guandalini	Giulio	Politecnico di Milano (E)	giulio.guandalini@polimi.it	Italy
27	Hawksworth	Stuart	HSL (P)	Stuart.Hawksworth@hsl.gsi.gov.uk	UK
28	Hinds	Gareth	NPL (P) (SB)	gareth.hinds@npl.co.uk	UK
29	Jedicke	Olaf	H2FC coordinator (SB)	olaf.jedicke@kit.edu	Germany
30	Jeppesen	Christian	Aalborg University (E)	chj@et.aau.dk	Denmark
31	Jorcin	Jean-Baptiste	Tecnalia (P) (SB)	jbaptiste.jorcin@tecnalia.com	Spain
32	Jordan	Thomas	KIT (P)	thomas.jordan@kit.edu	Germany
33	Justesen	Kristian	Aalborg University (E)	kju@et.aau.dk	Denmark
34	Joseph	Paul	UU (E)	p.joseph@ulster.ac.uk	UK
35	Kashkarov	Sergii	UU (E)	Kashkarov-S@email.ulster.ac.uk	Ukraine
36	Keenan	James	UU (O)	j.keenan@ulster.ac.uk	UK
37	Keller	Jay	Zero Carbon Energy Solutions, DoE (E-f)	jay.o.keller@gmail.com	USA

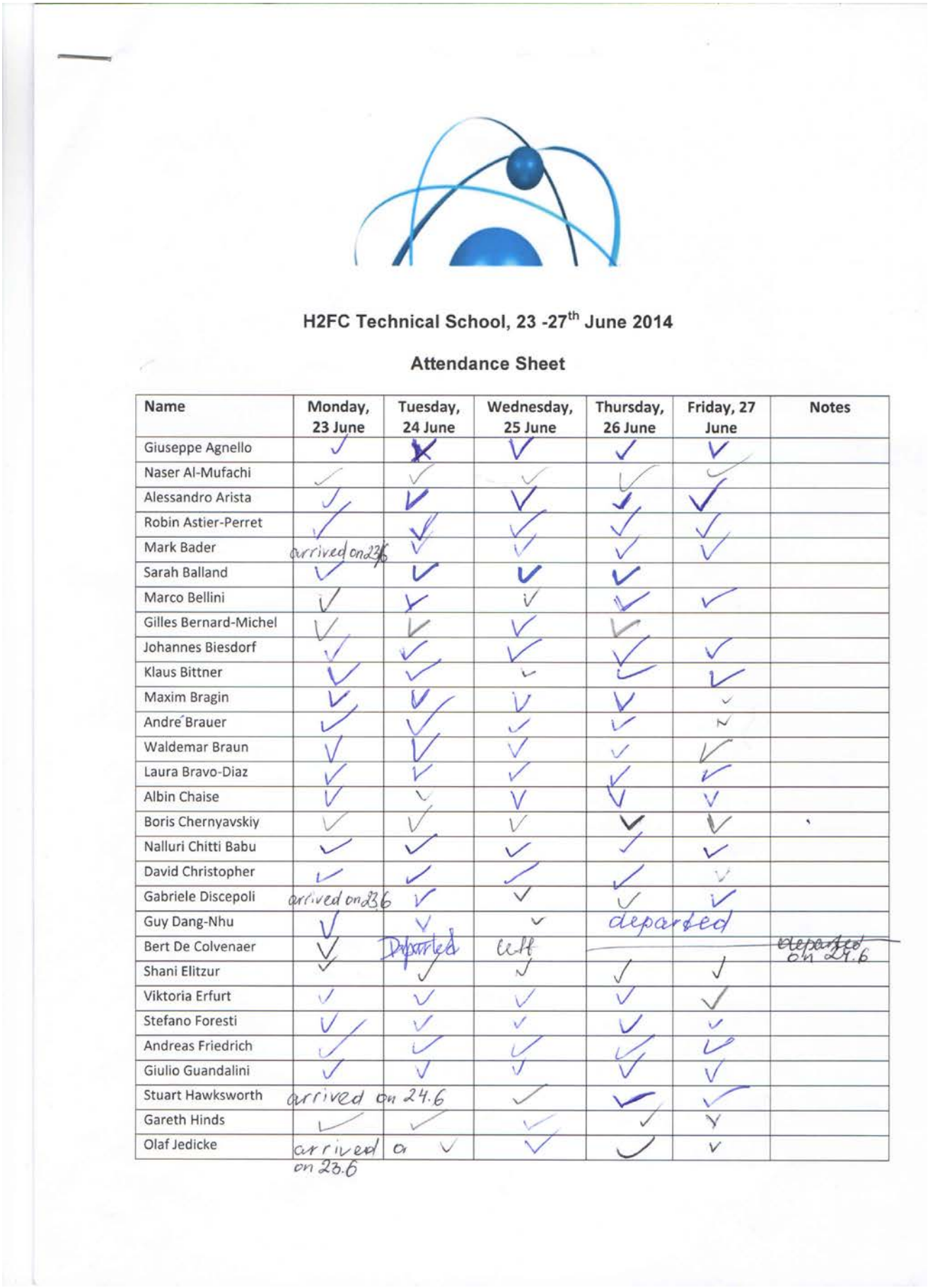
38	Kotchourko	Alexei	KIT (P)	alexei.kotchourko@kit.edu	Germany
39	Kucernak	Anthony	Imperial College London (E)	anthony@imperial.ac.uk	UK
40	Kuznetsov	Mikhail	KIT (P)	mike.kuznetsov@kit.edu	Germany
41	Lamberti	Thomas	University of Genoa (E-f)	thomas.lamberti@edu.unige.it	Italy
42	Ledin	Stefan	HSL (P) (SB)	Stefan.Ledin@hsl.gsi.gov.uk	UK
43	Li	Zhiyong	Tongji University (E)	zjxulzy@gmail.com	China
44	Maher	Aloufi	Saudi Basic Industries Corporation (E)	oufiME@SABIC.com	Saudi Arabia
45	Makarov	Dmitriy	UU (O)	dv.makarov@ulster.ac.uk	UK
46	Mays	Tim	University of Bath (E-f)	t.j.mays@bath.ac.uk	UK
47	McPhail	Stephen	ENEA (P)	stephen.mcphail@enea.it	Italy
48	Melideo	Daniele	JRC (P)	Daniele.MELIDEO@ec.europa.eu	The Netherlands
49	Mertens	Josef	Jülich (P) (SB)	jo.mertens@fz-juelich.de	Germany
50	Meyer	Jean	Private (E)	jeanmey@gmx.de	Germany
51	Micari	Salvatore	C.N.R. I.T.A.E. (E)	micari@itae.cnr.it	Italy
52	Milewski	Jarek	Warsaw University of Technology (E)	milewski@itc.pw.edu.pl	Poland
53	Mirandola	Amelia	University of Calabria (E)	amelia.mirandola@unical.it	Italy
54	Molkov	Vladimir	UU (O)	v.molkov@ulster.ac.uk	UK
55	North	Brian	HySA Infrastructure (E)	bnorth@csir.co.za	Republic of South Africa
56	O'Sullivan	Louise	HSL (P)	louise.osullivan@hsl.gsi.gov.uk	UK
57	Peksen	Murat	Jülich (E)	m.peksen@fz-juelich.de	Germany
58	Quinaud	Manuelle	CEA (P)	Manuelle.QUINAUD@cea.fr	France
59	Sahlin	Simon L	Aalborg University (E)	sls@et.aau.dk	Denmark
60	Sampson	James	Zero Carbon Futures (E)	james.sampson@gateshead.ac.uk	UK
61	Su	Tina	Glasgow University (E-f)	tinasu@chem.gla.ac.uk	New Zealand
62	Swart	Gerhard	HySA systems (E-f)	gswart@hysasystems.org	Republic of South Africa
63	Thanou	Ioanna-Viktoria	Alstom Switzerland (E)	ioanna.thanou@power.alstom.com	Switzerland
64	Tretsiakova-McNally	Svetlana	UU (O) (SB)	s.tretsiakova-mcnally@ulster.ac.uk	UK
65	Valle	Francesco	University of Trieste (E-f)	fvalle@units.it	Italy
66	Verbecke	Franck	Areva (E-f)	franck.verbecke@areva.com	France
67	Vinke	Ico	Jülich (P)	i.c.vinke@fz-juelich.de	Germany
68	Vishweshwara Naidu	Sureddy	Andhra University (E)	profnaidu90@gmail.com	India
69	Williams	Ross	GE Aviation (E)	Ross.Williams@ge.com	UK
70	Yiotis	Andreas	NCSRD (P)	yiotis@ipta.demokritos.gr	Greece
71	Züttel	Andreas	EMPA (P) (SB)	andreas.zuettel@empa.ch	Switzerland

(O)- organisers of the School; (P) – partner of the H2FC Project; (E) – external, self-funded participant; (E-f) – external participant funded by H2FC; (SB) – member of the School Board.

Annex 6. Invited speakers at TS2014

1	David Christopher	Tsinghua University, China
2	Guy Dang-Nhu	Air Liquide, France
3	Bert De Colvenaer	FCH-JU, Belgium
4	Olaf Jedicke	KIT, Germany
5	Thomas Jordan	KIT, Germany
6	Jay Keller	Zero Carbon Energy Solutions, DoE, USA
7	Anthony Kucernak	Imperial College London, UK
8	Tim Mays	University of Bath, UK
9	Gerhard Swart	HySA systems, Republic of South Africa
10	Andreas Züttel	EMPA, Switzerland

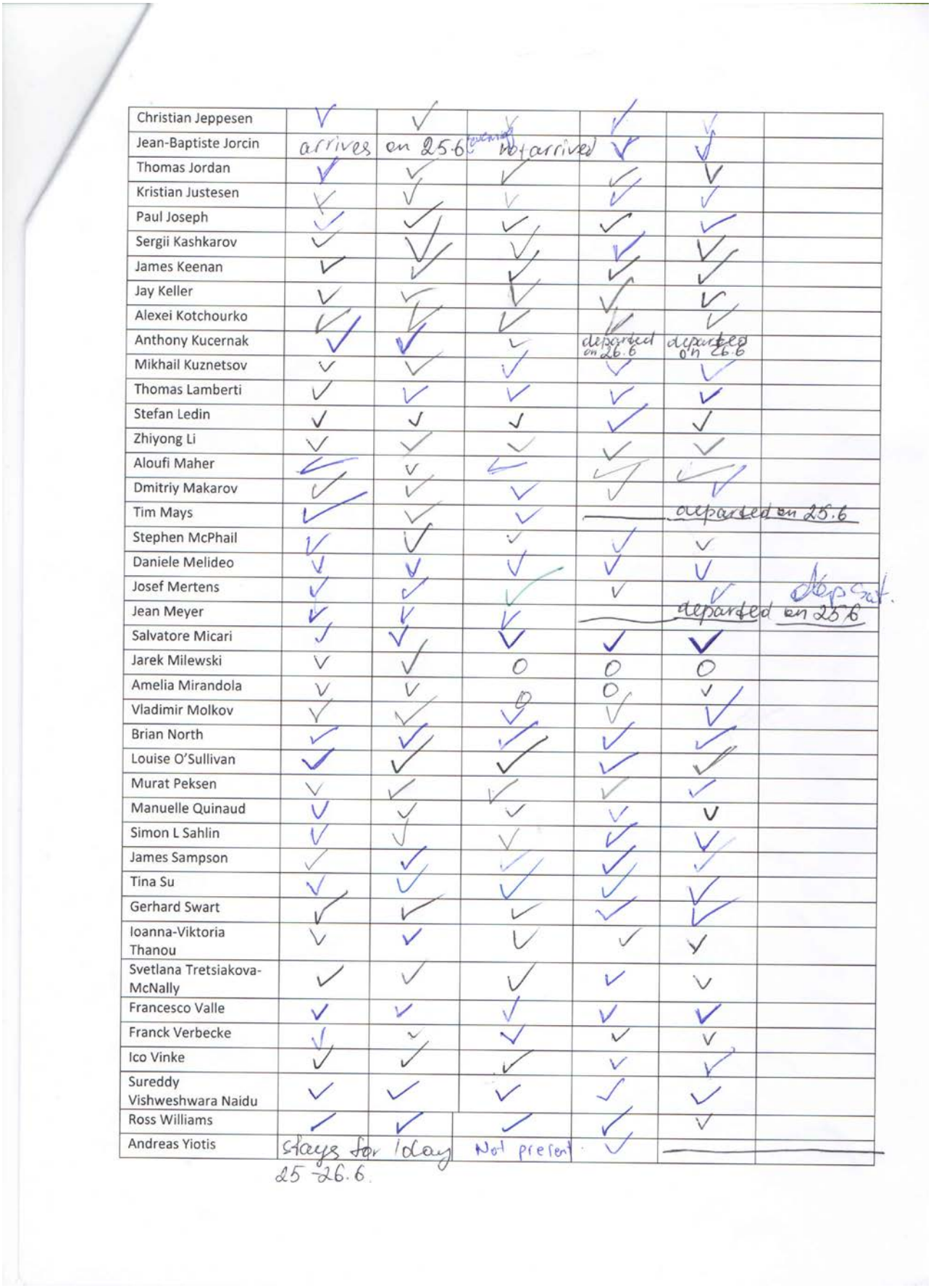
Annex 7. Attendance sheet of TS2014



H2FC Technical School, 23 -27th June 2014

Attendance Sheet

Name	Monday, 23 June	Tuesday, 24 June	Wednesday, 25 June	Thursday, 26 June	Friday, 27 June	Notes
Giuseppe Agnello	✓	✗	✓	✓	✓	
Naser Al-Mufachi	✓	✓	✓	✓	✓	
Alessandro Arista	✓	✓	✓	✓	✓	
Robin Astier-Perret	✓	✓	✓	✓	✓	
Mark Bader	arrived on 23.6	✓	✓	✓	✓	
Sarah Balland	✓	✓	✓	✓		
Marco Bellini	✓	✓	✓	✓	✓	
Gilles Bernard-Michel	✓	✓	✓	✓		
Johannes Biesdorf	✓	✓	✓	✓	✓	
Klaus Bittner	✓	✓	✓	✓	✓	
Maxim Bragin	✓	✓	✓	✓	✓	
André Brauer	✓	✓	✓	✓	✓	
Waldemar Braun	✓	✓	✓	✓	✓	
Laura Bravo-Diaz	✓	✓	✓	✓	✓	
Albin Chaise	✓	✓	✓	✓	✓	
Boris Chernyavskiy	✓	✓	✓	✓	✓	
Nalluri Chitti Babu	✓	✓	✓	✓	✓	
David Christopher	✓	✓	✓	✓	✓	
Gabriele Discepoli	arrived on 23.6	✓	✓	✓	✓	
Guy Dang-Nhu	✓	✓	✓	departed		
Bert De Colvenaer	✓	departed	left			~~departed~~ on 24.6
Shani Elitzur	✓	✓	✓	✓	✓	
Viktoria Erfurt	✓	✓	✓	✓	✓	
Stefano Foresti	✓	✓	✓	✓	✓	
Andreas Friedrich	✓	✓	✓	✓	✓	
Giulio Guandalini	✓	✓	✓	✓	✓	
Stuart Hawksworth	arrived on 24.6		✓	✓	✓	
Gareth Hinds	✓	✓	✓	✓	✓	
Olaf Jedicke	arrived on 23.6	✓	✓	✓	✓	



Christian Jeppesen	✓	✓	✓	✓	✓	
Jean-Baptiste Jorcin	arrives	on 25.6	not arrived	✓	✓	
Thomas Jordan	✓	✓	✓	✓	✓	
Kristian Justesen	✓	✓	✓	✓	✓	
Paul Joseph	✓	✓	✓	✓	✓	
Sergii Kashkarov	✓	✓	✓	✓	✓	
James Keenan	✓	✓	✓	✓	✓	
Jay Keller	✓	✓	✓	✓	✓	
Alexei Kotchourko	✓	✓	✓	✓	✓	
Anthony Kucernak	✓	✓	✓	departed on 26.6	departed on 26.6	
Mikhail Kuznetsov	✓	✓	✓	✓	✓	
Thomas Lamberti	✓	✓	✓	✓	✓	
Stefan Ledin	✓	✓	✓	✓	✓	
Zhiyong Li	✓	✓	✓	✓	✓	
Aloufi Maher	✓	✓	✓	✓	✓	
Dmitriy Makarov	✓	✓	✓	✓	✓	
Tim Mays	✓	✓	✓	—	departed on 25.6	
Stephen McPhail	✓	✓	✓	✓	✓	
Daniele Melideo	✓	✓	✓	✓	✓	
Josef Mertens	✓	✓	✓	✓	✓ dep Sat.	
Jean Meyer	✓	✓	✓	—	departed on 25.6	
Salvatore Micari	✓	✓	✓	✓	✓	
Jarek Milewski	✓	✓	0	0	0	
Amelia Mirandola	✓	✓	0	0	✓	
Vladimir Molkov	✓	✓	✓	✓	✓	
Brian North	✓	✓	✓	✓	✓	
Louise O'Sullivan	✓	✓	✓	✓	✓	
Murat Peksen	✓	✓	✓	✓	✓	
Manuelle Quinaud	✓	✓	✓	✓	✓	
Simon L Sahlin	✓	✓	✓	✓	✓	
James Sampson	✓	✓	✓	✓	✓	
Tina Su	✓	✓	✓	✓	✓	
Gerhard Swart	✓	✓	✓	✓	✓	
Ioanna-Viktoria Thanou	✓	✓	✓	✓	✓	
Svetlana Tretsiakova-McNally	✓	✓	✓	✓	✓	
Francesco Valle	✓	✓	✓	✓	✓	
Franck Verbecke	✓	✓	✓	✓	✓	
Ico Vinke	✓	✓	✓	✓	✓	
Sureddy Vishweshwara Naidu	✓	✓	✓	✓	✓	
Ross Williams	✓	✓	✓	✓	✓	
Andreas Yiotis	stays for 1 day 25-26.6		Not present	✓	—	

Andreas Züttel	—	✓	✓	✓	✓	

Annex 8. Participants' questionnaire

European Technical School on Hydrogen and Fuel Cells 2014
Feedback form
Aegean Pearl Hotel, Rethymnon, Crete, 23-27 June 2014

Your opinion is very valuable to us and will help us to improve our next school. We would appreciate if you could complete this form and return it to us before you leave. Please feel free to write additional comments.

Please tell us how satisfied were you with the following:

	Very Satisfied	Satisfied	Neither Satisfied nor Unsatisfied	Unsatisfied	Very Unsatisfied
1. How satisfied were you with the registration process?					
2. How satisfied were you with the teaching materials provided?					
3. Overall, how satisfied were you with the lecturers / presenters?					
4. Overall, how satisfied were you with the Technical School facilities?					
5. How satisfied were you with the technical content of the School?					

6. How did you feel about the duration of the sessions?	Too long	Just about right	Too short
Topical Lectures			
Transnational Access and Instrumentation Workshop			
Cyber Laboratory			
Advanced Research Workshop			

If you have any comments related to the above questions please let us know:

7. Were you a student or a lecturer at the Technical School?	Student (learner)	Lecturer (teacher)	Both

Please tell us how much you agree with the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
8. I have acquired new knowledge in hydrogen and fuel cell science.					
9. The Technical School was well organized					
10. Any queries to the organisers were answered promptly and clearly.					
11. The hotel was of a high standard and fit for purpose.					

Page 1 of 2: Please turn over!

12.What kind of themes or topics would you like to be included in the Technical School 2015?

13.Would you like to receive H2FC newsletters, announcements about the technical school, calls, project results, benefits, etc? Yes/No

14.What did you like least about the Technical School?

15.What did you like most about the Technical School?

16.Are you familiar with H2FC Transnational Access experimental installations?

17.Do you have any suggestions for additional engineering tools to be included into Cyber-Laboratory?

	Yes	No	Not Sure
18. Do you plan to attend the Technical School next year?			
19. Would you recommend the Technical School to others?			

20.In what ways could the Technical School be improved?

21.Would you like to see lectures delivered via video conference call? Yes/No

22.Do you have suggestions for the location of the next school?

23.Any other comments

Thank you for taking the time to complete this questionnaire. Your feedback is valuable. This questionnaire is anonymous. However, if you would like us to respond to you regarding any of your answers then please include your name and indicate the questions you would like us to respond to.

Name (optional) _____

Annex 9. A brief summary of the newspaper article

European Technical School on Hydrogen and Fuel Cells 2014 in Rethymnon, Crete

The researchers emphasize that replacing fossil fuels with hydrogen is an ecological and sustainable solution and they are optimistic to achieve this goal

Scientists around the world study heavily and thoroughly the prospects of using hydrogen to generate electricity and in particular the replacement of gasoline used as fuel in cars. After getting the green light from the European Commission, this subject is at the research stage of the scientific community that believes in an ecological solution that respects and protects the environment. The ongoing research is being funded by the European Commission and according to the researchers the program that is dedicated to the exploration of the idea is on the right track and the results so far very promising.

The sessions during the European Technical School in Rethymnon are related to the hydrogen safety and hydrogen storage as well as the use of hydrogen in fuel cells.

"It is an honor for Rethymnon to be hosting this conference whose subject is considered as a solution for covering the future energy needs of the planet, a solution fully supported by the European Commission", claim the representatives of the Aegean Pearl Beach Hotel.

Andreas Yiotis, researcher at the National Centre for Scientific Research Demokritos, referring to the seminar said: "There are many issues to be addressed, such as hydrogen production, storage, transport, the risk and the safety issues involved in this whole process and also combusting hydrogen, i.e. how we can use hydrogen to produce electricity. It is a fast developing technology. The problem with hydrogen is that it does not exist free in nature, we need to spend energy to produce hydrogen, e.g. electrolysis is a method that can be used to produce hydrogen in a sustainable (CO2 free) way. Hydrogen is what we call an energy carrier. Hydrogen needs to be produced in a centralized or decentralized manner and then it can be utilized in mobile, non-mobile and large-scale applications.

On his side, the host of the technical school, Dr. Vladimir Molkov, stated that two car manufacturing companies are planning to commercialize hydrogen-fueled cars already next year. Hyundai and Toyota will be able to produce fuel cell vehicles (FCVs) next year. FCVs run on hydrogen gas rather than gasoline and emit no harmful emissions. Several challenges must be overcome before these vehicles will be competitive with conventional vehicles, but the potential benefits of this technology are substantial. According to Dr. Molkov, the potential of hydrogen can also be demonstrated at its use for hot water production in boilers for household purposes. One of the participants is the representative of the U.S. Department of Energy, a fact that shows the big U.S. interest on the European activities in hydrogen related research. The European Commission has increased the budget dedicated to research activities to 1.2 billion Euros for the next 5 years.

It should be mentioned that the H2FC European Infrastructure Project is a program fully created and supported by the European Commission with the goal to support science and development of Hydrogen- and Fuel Cell Technologies towards European Strategy for Sustainable, Competitive and Secure Energy.