Grant agreement number: 779730

WP 7 - Network management and exchange

D7.5 Project Gathering Year 3

Due date: 30/11/2020

Lead participant name: ULB

List of contributors: UBHAM

Status: Final (updated)

Dissemination level: PU

Last updated: 31/12/2020

Document History

Issue Date	Version	Changes Made/Comments
27/12/2020	1	1st draft
31/12/2020	2	edits prior to submission
20/07/2021	2.1	EU funding statement update following review request removed participant list and replaced by slide set documentation

Disclaimer and Acknowledgment:

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 779730. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.

Any opinions expressed in this report are solely those of the authors and neither of the FCH 2 JU, nor the European Commission or its representatives.

Table of Contents

About TeacHy

As the FCHT industry gradually emerges into the markets, the need for trained staff becomes more pressing. TeacHy2020, or short TeacHy, specifically addresses the supply of undergraduate and graduate education (BEng/BSc, MEng/MSc, PhD etc.) in fuel cell and hydrogen technologies (FCHT) across Europe.

TeacHy2020 will take a lead in building a repository of university grade educational material, and design and run an MSc course in FCHT, accessible to students from all parts of Europe. To achieve this, the project has assembled a core group of highly experienced institutions working with a network of associate partners (universities, vocational training bodies, industry, and networks). TeacHy offers these partners access to its educational material and the use of the MSc course modules available on the TeacHy site. Any university being able to offer 20 to 30% of the course content locally, can draw on the other 80 to 70% to be supplied by the project (and its successor entity that will support the platform post-project).

This will allow any institution to participate in this European initiative with a minimised local investment. TeacHy will be developing solutions to accreditation and quality control of courses, and support student and industry staff mobility by giving access to placements. Schemes of Continuous Professional Development (CPD) will be integrated into the project activities. We expect a considerable leverage effect which will specifically enable countries with a notable lack of expertise, not only in Eastern Europe, to quickly be able to form a national body of experts.

TeacHy will offer some educational material for the general public (e.g. MOOC's), build a business model to continue operations post-project, and as such act as a single-stop shop and representative for all matters of European university and vocational training in FCHT. The project partnership covers the prevalent languages and educational systems in Europe. The associated network has over 70 partners, including two IPHE countries, and a strong link to IPHE activities in education.

The project started on 01/11/2017 and has now been extended to end on 31/10/2022.

Deliverable Abstract

This deliverable D7.5 covers the activities outlined in the Task 7.3 taken from the TeacHy Description of Work, as shown below.

Task 7.3 – Manage Annual Project Gatherings (M10, M22, M34) (UBHAM, ULB)

Once a year, all project partners will gather in the form of a (tribal) assembly to discuss the project progress, develop new ideas in producing project outcome, and discuss FCH teaching and progress in general. These gatherings are to mix professional content presentation and management with creativity, fun elements, and general motivation of everyone contributing to the project. Competitions could be held to help stimulate knowledge transfer across the community. These events could also be used to provide networking opportunities for TeacHy2020 students not only amongst themselves but also with the wider teaching community.

1 Objective

Once a year, all TeacHy project partners and the Associate Partner Network gather in the form of an assembly to discuss the project progress, develop new ideas in producing project outcomes, and discuss FCH teaching and training progress in general. These gatherings are meant to mix professional content presentations and management, with creativity, fun elements, and general motivation of everyone contributing to the TeacHy project. The yearly gathering event intends also to help stimulate H2-related knowledge transfer across the education community and the larger society. This event is also used to provide networking opportunities for TeacHy partners, not only amongst themselves but also with the wider teaching and research community, as well as industry, in Europe and preferably in the presence of the JU FCH representative(s).

2 The Gathering Event Year 3

Due to the ongoing COVID pandemic and the limitations to (and impossibility of) any in-person gatherings in Brussels at the time, this 3rd TeacHy Gathering Event was organised online (using the platform Zoom) by TeacHy partner ULB on the 30th of November 2020. The programme and agenda of the day are given in Appendix 1 and the list of participants is attached as Appendix 2.

Regularly, the Gathering would occur on the day before the FCH JU Programme Review Days. Since these had been moved at short notice in order to be part of the Hydrogen Week 'in Brussels' series of events in the week commencing with 23 Nov 2020, the TeacHy event was postponed to the following week.

The Gathering agenda included the usual updates, but also presented insights into creating inline content, as well as giving industry partners a platform.

A surprisingly large number of people (34 in total, representing universities across the globe, incl. Russia and Brazil, and companies) attended this half-day event, with all TeacHy partners present and with a presentation prepared by the scientific officer of the JU FCH. The beginning of the meeting was devoted to the presentation of the different work packages and the progress of the TeacHy project itself, including an introduction given by the JU FCH. After that, the meeting was devoted to an interaction between the coordinator, the consortium partners and the audience on the way to proceed, the remaining questions, the life of the course material after the end of the project, and a presentation by the public transport body of the Brussels-Capital Region that is very interested in H_2 buses and the use of HRS and the related training needs.

All presentations of the Gathering Event Year 3 are available as slide sets on the TeacHy website,

www.teachy.eu

which also offers the recording of the complete meeting.

Appendix 2 also includes the slide sets.

3 Summary and Conclusions

Through this dense half day-event, the TeacHy partners got the opportunity to present their project to the hydrogen and fuel cell community in Europe, including industry and interested industrial customers for the already prepared learning material and to show the progress of the TeacHy project about three years after the start of the project.

Half of the participants were not partner of the consortium project, so the opportunity has really been offered and taken to connect the TeacHy partners to other actors in the field, among them students.

In this difficult pandemic situation, one should certainly consider this 3rd Gathering Event as a success from the point of view of the organisers and of the TeacHy consortium. It helped and will continue helping in creating a good and active network with other actors in the field and potential users of the TeacHy learning material. From that point of view, the availability of the meeting recording on the project website can be considered as positive.

After 2 Gathering Events onsite and now this 3rd Gathering Event online, the organisers have now obtained considerable experience that will be put to good use when providing the next two and last Gathering Events in 2021 and 2022, as the project is now extended by 2 years (Year 4 and Year 5).

Appendix 1 – Agenda of the 3rd Gathering Event in Brussels

JU FCH TeacHy project

3rd Gathering Event

30 November 2020

ULB – Online – Zoom platform

Programme of the day

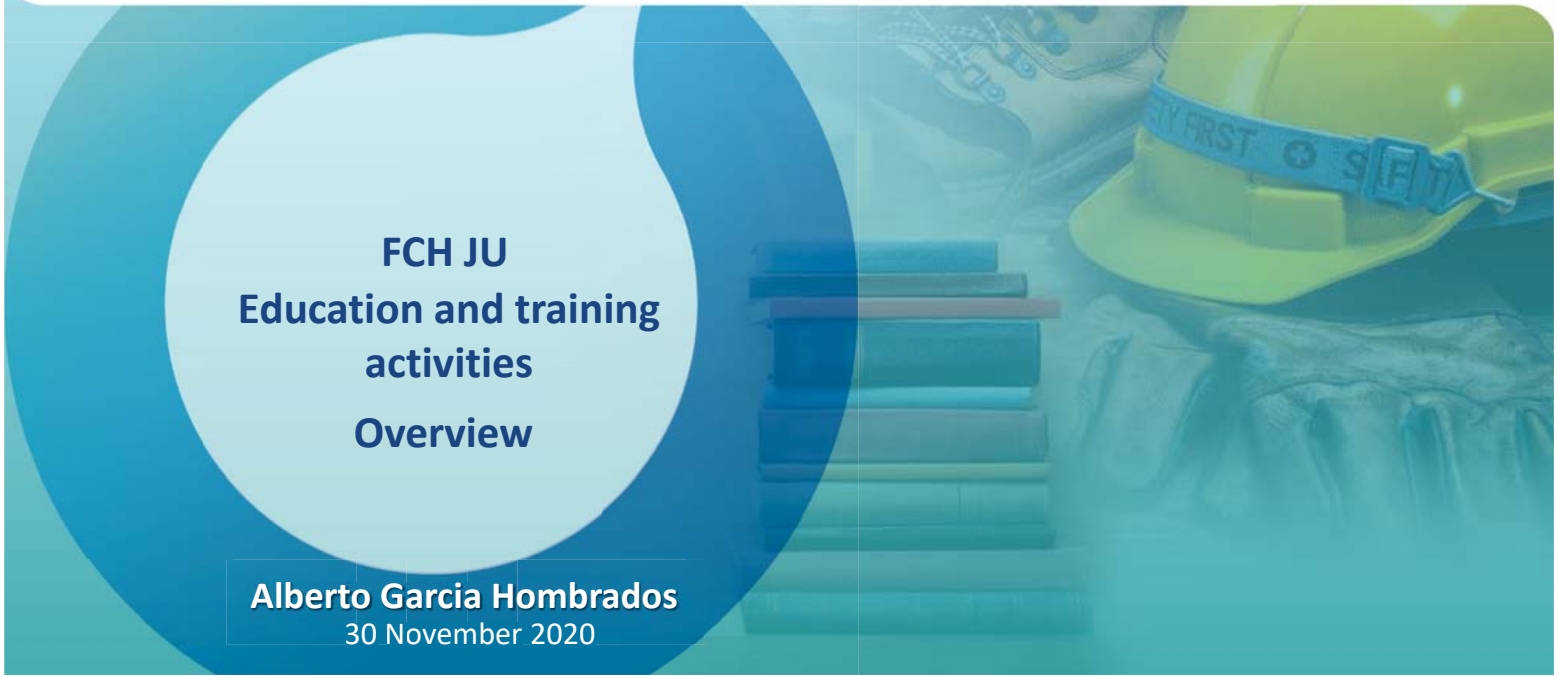
From 10:00 am (virtual tea & coffee)

10:00 Start of the meeting and Welcome Words (P. Hendrick)
10:05 The Teachy project and the JU FCH objectives (A. Garcia Hombrados)
10:15 Introduction and Status of TEACHY (R. Steinberger)
10:30 CPD efforts in The Netherlands (A. Purushothaman)
10:45 Creating online content (I. Iordache)
11:00 The TIME network and Teachy interest (J-L. Delplancke)
11:15 A Lab demo as taught in Teachy (M. Santarelli)
11:30 Potential Teachy user: the public transport operator in the Brussels-Capital Region (STIB – Ph. Vandewauwer)
11:45 Brainstorming / Q&A time
12:00 Adjournment of the meeting

Registration is free of charge via Mrs Shirley Wayne: *swayne@ulb.ac.be*

Appendix 2 – Slides shown at the meeting

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING



FCH JU
Education and training activities
Overview

Alberto Garcia Hombrados
30 November 2020

Strong public-private partnership with a focused objective

EU Institutional Public-Private Partnership (IPPP)

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

Fuel Cells & Hydrogen 2 Joint Undertaking (FCH 2 JU)

Hydrogen Europe
Industry grouping
More than 160 members, 50% SME

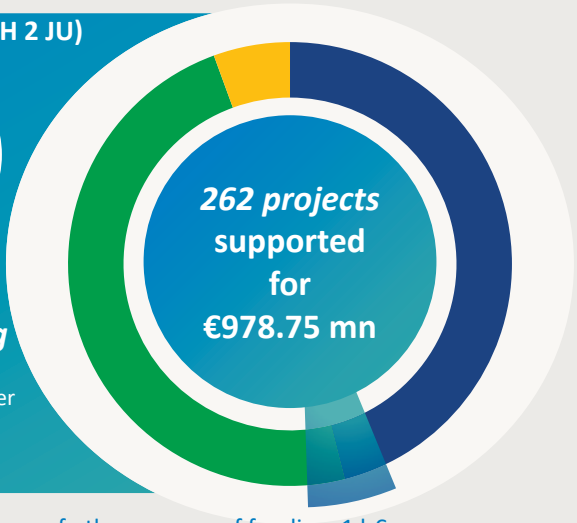
European Commission
(FP7; H2020)
DGs RTD, ENER, MOVE

Hydrogen Europe Research
Research grouping
almost 80 members

Energy
H_2 production and distribution
H_2 storage
F/C for CHP

Transport
Road vehicles
Non-road vehicles
Refueling infra
Maritime, rail and aviation applications

Cross-cutting
standards, safety, education, consumer awareness, …



46%
EUR 450.5 million
144 projects

41%
EUR 404 million
70 projects

6%
EUR 58 million
43 projects

7%
EUR 66 million
5 projects

Similar leverage of other sources of funding: 1 b€

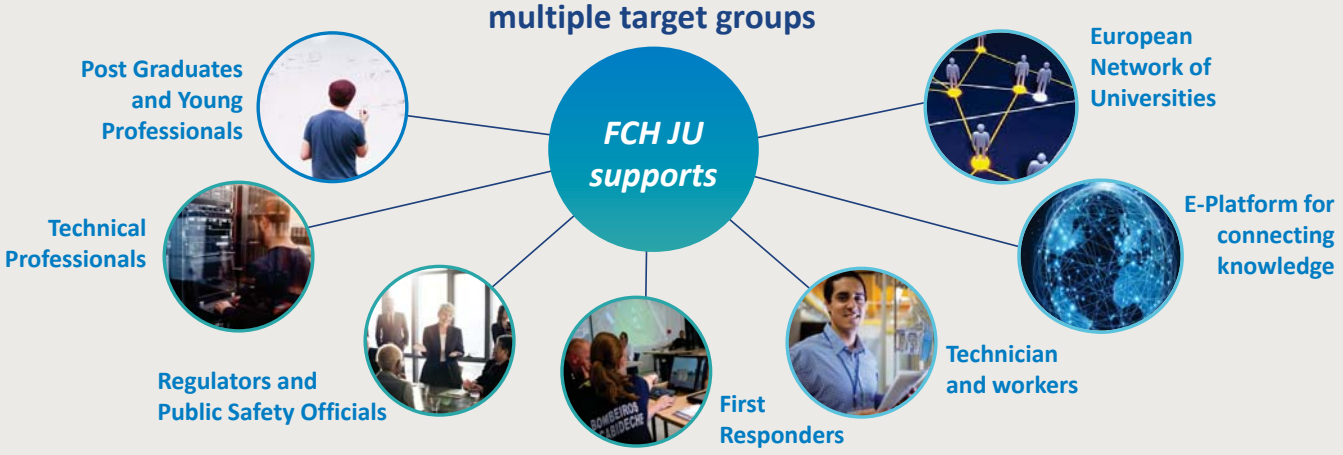
Cross-cutting Activity Area

Activity Areas

Educational Activities – Overview

Promoting the excellence in education and training, preparing the European workforce

Educational and training programs tailored to multiple target groups

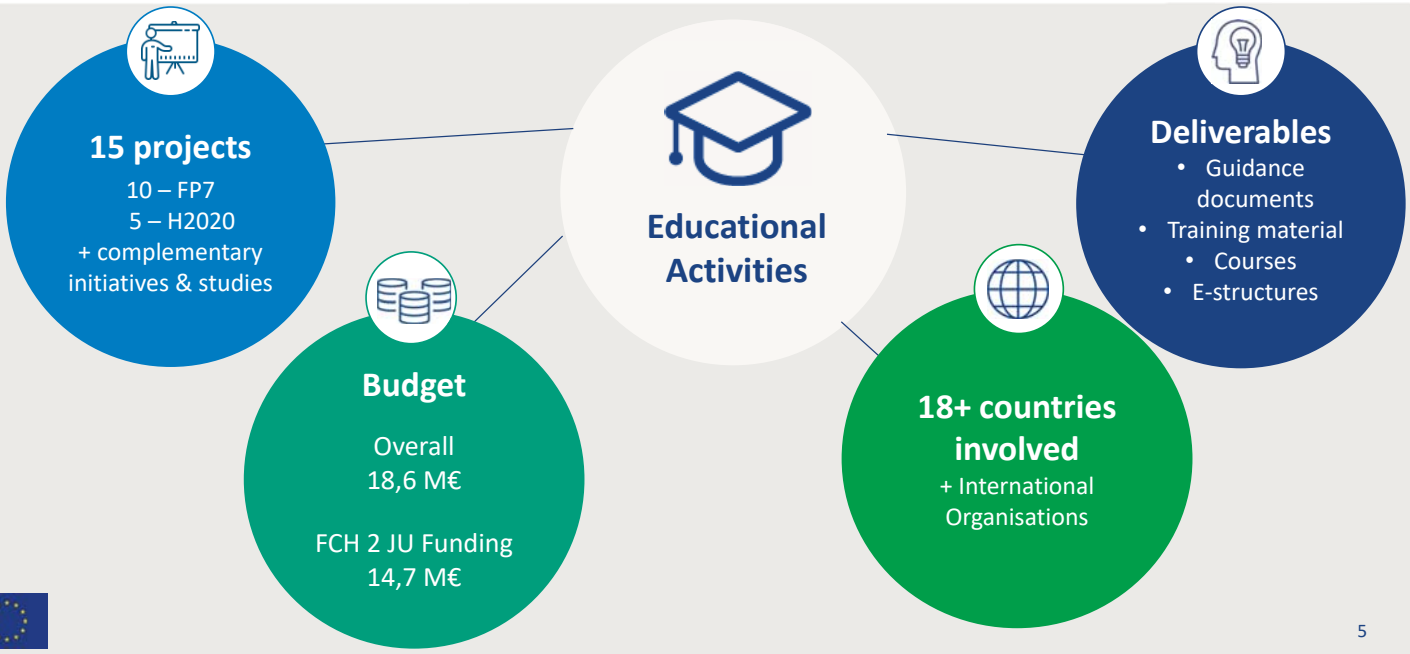


Multiple levels and types of education, learning formats, features…

Graduate *Undergraduate* … *In person training* … *Serious games* *Mock-up installations*
Vocational *Compulsory* … *e-learning* *blended* … *Virtual reality*

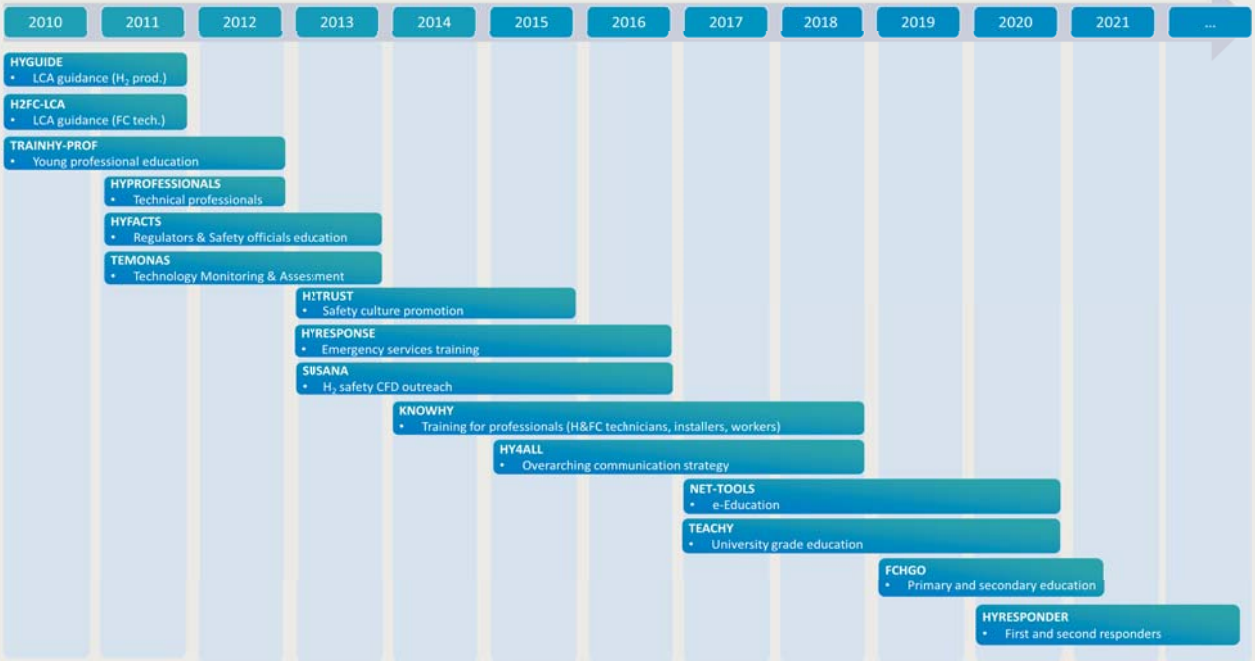
Educational Activities – Overview

Preparing the European workforce, promoting excellence in education and training on FCH technologies



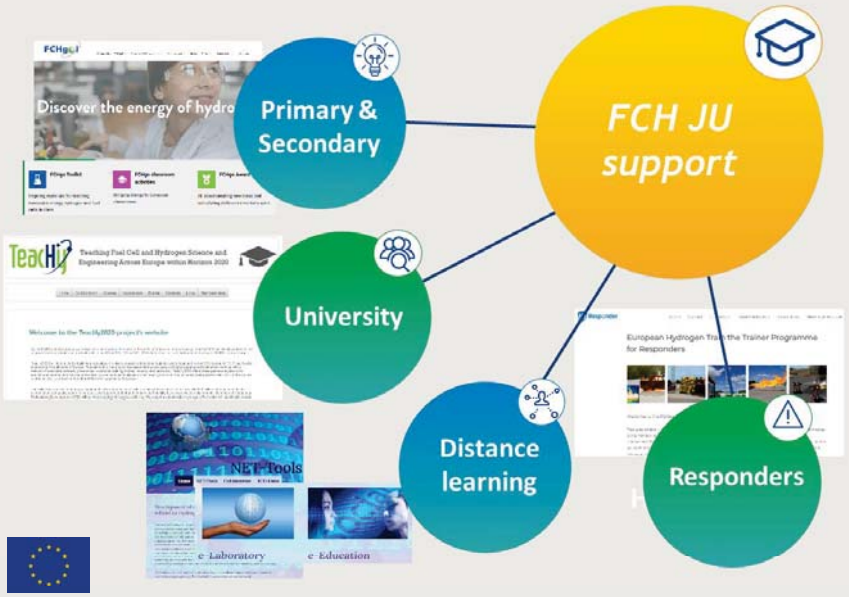
Educational Activities – Overview

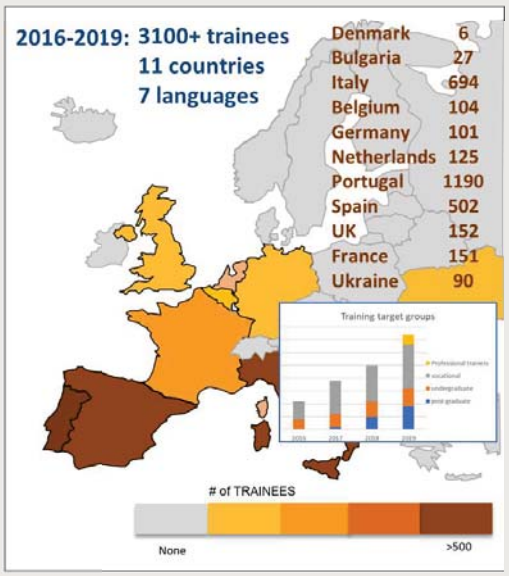
Continuous support throughout the FCHJU programme lifetime



Education and training

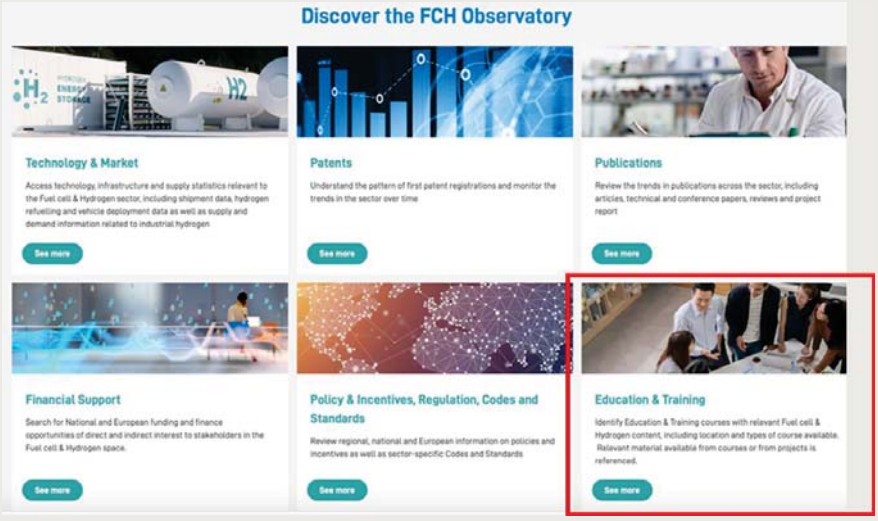
Projects ongoing in 2020





FCH Observatory

Resource for all things Fuel Cells & Hydrogen



What is the FCHO?

- Global resource
- User friendly and reliable output
- Charts, graphs and data downloads
- Insight reports

Includes chapters on

- Technology & Market
- Policies & regulation
- Codes & Standards
- Patents & Publications
- Funding
- Education & Training

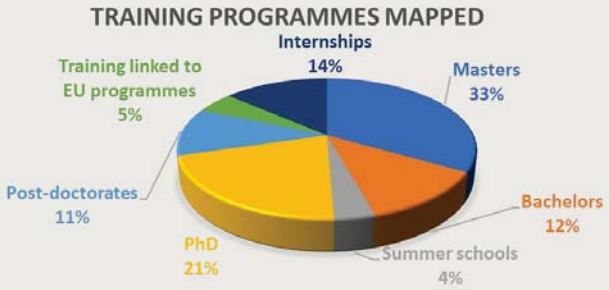
www.fchobservatory.eu

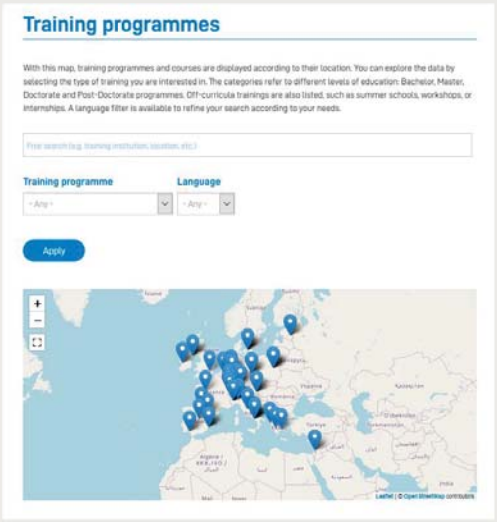
FCH Observatory

Education and training chapter – 86 training programmes and courses

Training programmes

- To date, **86 training programmes and courses are listed in the FCHO.**
- The data has been collected by responses to a questionnaire sent to all Hydrogen Europe Research membership covering universities and research organisations.





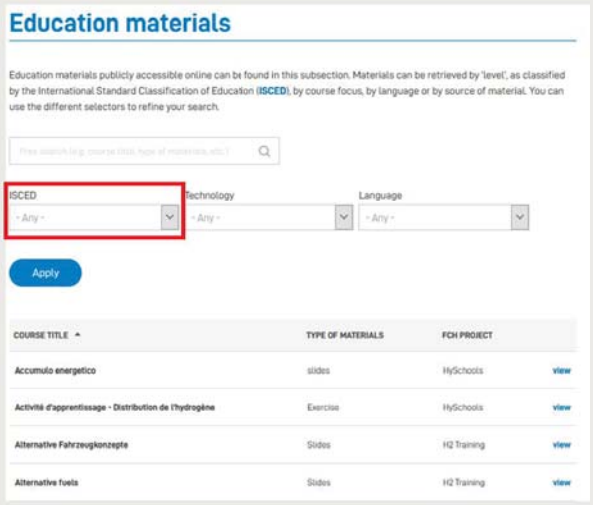
FCH Observatory

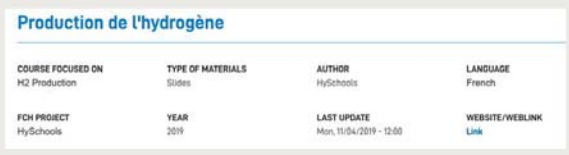
Education and training chapter - About 250 materials

Education materials

- **Thanks to different selectors, materials can be retrieved:**
  - by ISCED level
  - by course focus
  - by language

ISCED is the reference international classification for organising education programmes and related qualifications by levels and fields.





FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

Alberto J. Garcia Hombrados
Project officer
Alberto.GarciaHombrados@fch.europa.eu

For further information
www.fch.europa.eu

@fch_ju

Fch-ju@fch.europa.eu

FCH JU

TeacHy

Teaching Fuel Cell and Hydrogen Science and Engineering Across Europe within Horizon 2020

Robert Steinberger-Wilckens
University of Birmingham
www.teachy.eu
r.steinbergerwilckens@bham.ac.uk

TeacHy Team Overview

Project duration:
01-11-2017 – 31-10-2022

Partners

TeacHy - Teaching Fuel Cell and Hydrogen Science and Engineering Across Europe

Objectives

- establishing a blended learning MSc course to be delivered by a network of European universities
- establishing a focal point of advanced education in FCH technologies
- offering CPD and public educational materials and certified professional courses
- developing means of offering virtual and distance access to laboratory facilities
- implement public-facing material on the NET-Tools platform
- offering subscription/licensing of universities to the TeacHy concept

State of the Art

- no comparable online or blended learning offerings

TeacHy Motivation

- many universities cover single topics in FCH in courses such as Physics and Chemistry (thermodynamics, electrochemistry), Chemical & Mechanical engineering etc.
- within the EU only one (!) university offers an FCH MSc degree
- many universities are willing to contribute to FCH MSc programmes but can only cover about ~30% of the necessary lecturing material and capacity
- a number of 50 to 200 university MSc courses are needed to cover the HR demands by 2030 (~50,000 trained engineers/scientists)

→ how can the missing ~70% of teaching be supplied?

→ how can quality of teaching be assured in a high number of newly developed programmes?

TeacHy Actions

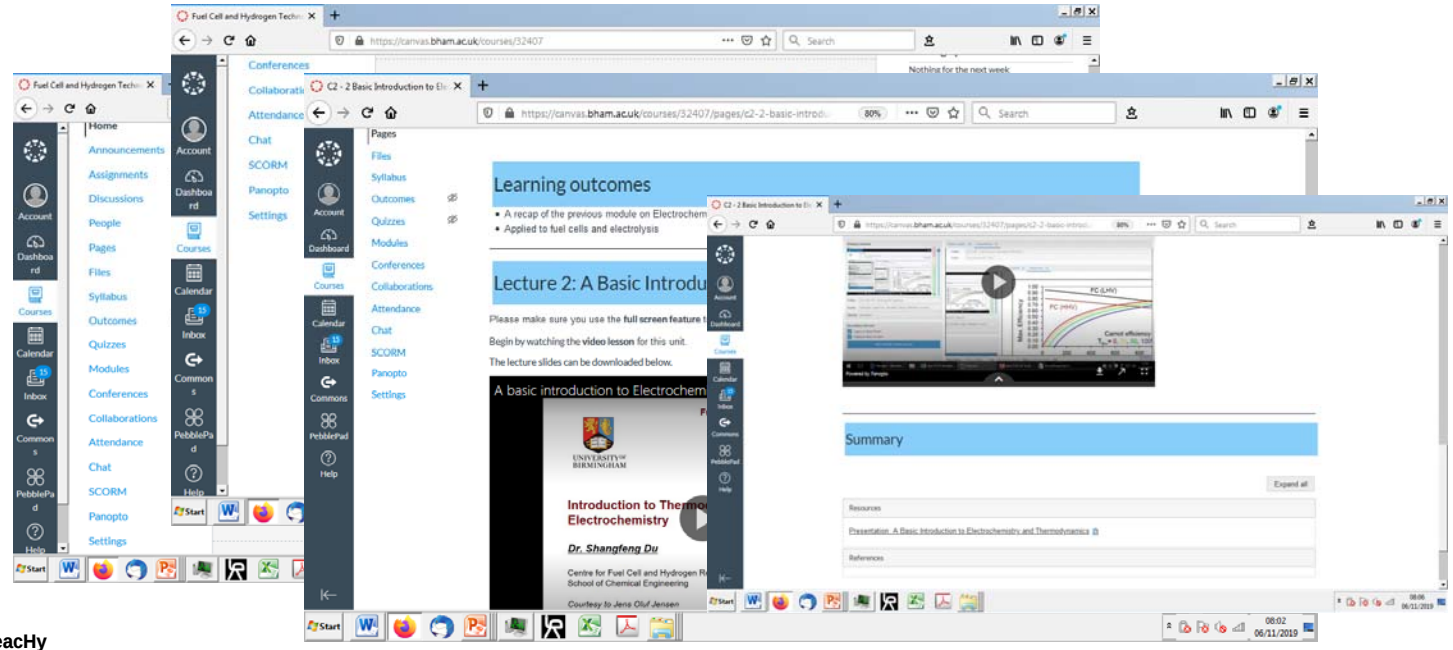
Project Deliverables

- implementing prototype full 12-month MSc programme on UoB LMS system
- running full or modified programmes (18 & 24 months) at other consortium partners
- adapting TeacHy content to CPD needs
- running CPD courses at TU Delft and RU Groningen, as well as with partnering organisations
- translating content to make access easier across Europe and build vocabulary

Project Associate Network

- offering modules and whole MSc programme to universities outside the consortium
- offering licensing and distance delivery of modules
- offering support with exams, labs, and research projects

TeacHy – CANVAS LMS Implementation Example



Lessons Learned

Accreditation procedures

- diversity of accreditation models at universities
- reluctance of university administrations to accept external contributions
- 'ownership' of modules

Financial issues

- divergence of university financing models and tuition charges
- reluctance of funding of educational activities – resulting in underfunding, considerable unpaid und unrecognised university input

Post-Project Business Plan

- establishment of a post-project business entity to maintain and update educational material database
- license model to have content implemented on local LMS, receive help in delivery (incl. exams, lab work, research projects), or run externally led modules
- implementation of CPD schemes
- cooperation with various educational initiatives:
  CPD in Saarland for automotive networks, Austria for automotive company, and Germany for group of logistics companies

Building on Previous Projects And Programmes

Interactions with projects funded under EU programmes

- TrainHy – MSc course based on syllabus developed by TrainHy
- HySafe – Hw safety module from HySafe
- KnowHy – blended learning and CPD approach

Interactions with national and international-level projects and initiatives

- IPHE – Educational Activities – represented by Jürgen Garche on Advisory Board
- EPSRC Supergen H2FC Hub – use of Educational Portal
- T.I.M.E. network – network partners

Interactions with private projects and initiatives

- JESS – Joint European Summer School – cooperation on module development and delivery

Where to find us …

Facebook group

Linkedin entry

Twitter feed

dedicated web site
www.TeacHy.eu
with blog and regular newsletter

Thank you for your attention and happy to answer any questions!

Robert Steinberger-Wilckens

University of Birmingham

www.teachy.eu

r.steinbergerwilckens@bham.ac.uk

Funding by the FCH 2 JU under contract #779730 is gratefully acknowledged, as well as the input from all project partners.

Agenda slot 3 was skipped due to unavailability of speaker

The evolution of didactical tools

and

creating online content

Ioan Iordache

JU FCH TeacHy project
3rd Gathering Event
30 November 2020

creating online content

it seem simple ….

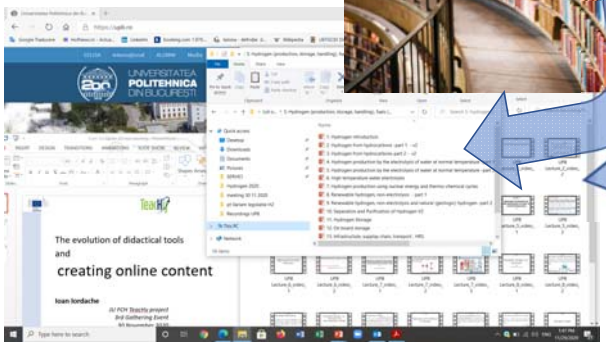
you document yourself

….upload data in

……your laptop

classic

internet

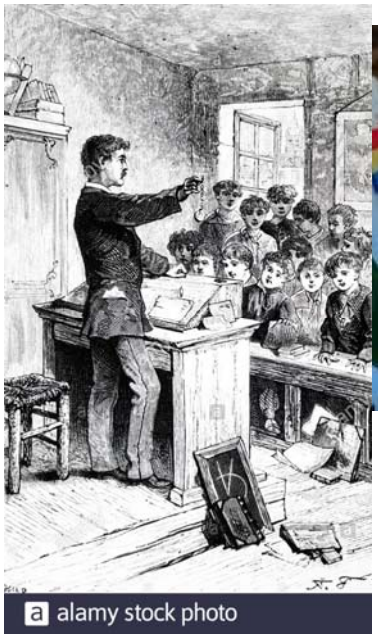


… the course is ready!

In order to create a didactic content you must understand and know the evolution of the didactic tools.

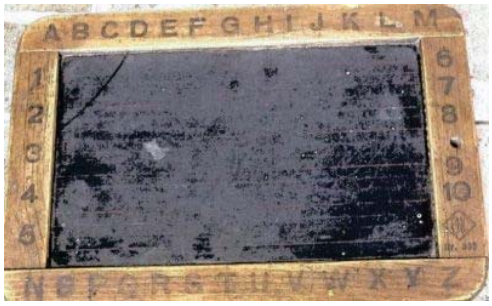
… is about the evolution from **tablet** to **tablet**

The evolution of didactical tools



in the 19th century

Slate “tablets”



Generations and generations, our grandparents and great-grandparents have learned to read and write on the "tablet." Simple tool, a slate board, in a wooden frame, associated with a stone "pen".

… more on https://en.wikipedia.org/wiki/Slate_(writing)

https://tribunainvatamantului.ro/de-la-tablita-la-tableta/

The evolution of didactical tools

in the 20th century

The evolution of didactical tools

ideal

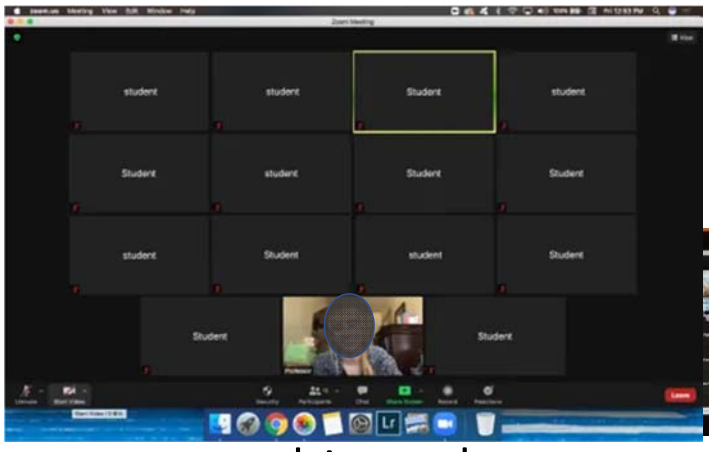
the 21st century

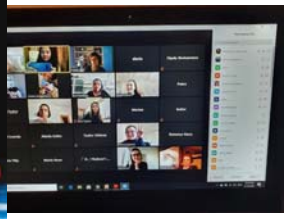
online

The evolution of didactical tools

real

the 21st century





You are speaking alone us your computers!

- the majority of students open a dark windows with the initials,
- some of them just put up a picture,
- and maybe .... maybe some of them are "complete" life.

Lesson learned when I creating online content

The English is the last problem!, before you start make sure that:

- the laptop is charged or plugged in,

- nobody call you,

- the neighbor does not start the drill, the vacuum cleaner, ...

- if you have the camera on, make sure you have your pants on,

…… and many more

Lesson learned when I creating online content

… after I have start the record or translation from English to Romanian:

- when I start the Zoom, …I start to made new modifications/improvement for slides,
- when I watched the video (zoom), I did not like them, I made a new one, which of course was much worse,
- when I start to translate in Romanian I found that I do not know how to explain in mine native language!

….. when all was ok ….the internet is down!

Our role as professors does not change!

….**but** the <u>digitalization means a lot more</u>, instead of assistants or PhD students, we would rather need actors, someone(or more) with a pleasant voice, TV operators, ... … finally a full TV team from Discovery!

What is a pen, notebook or pencil box?

Yes, our generation know!

Thank you for your attention!

…. but how many of us know how to use a quill pen?

3rd Gathering Event
November 30, 2020

Network management and exchange (WP7)

Jean-Luc Delplancke (Université Libre de Bruxelles)

Workpackage 7 Tasks

- **Task 7.1 – Manage and grow associate network** (**ULB**, UBHAM) **IN PROGRESS**
  - Management and continual effort will be made to further expand the associate network through dissemination and engagement with FCH stakeholders.
- **Task 7.2 – Manage staff exchange** (**ULB**) **ON HOLD DUE TO COVID**
  - A staff exchange programme will be setup and used to facilitate the movement of staff across the core and associate network to promote knowledge transfer and professional development. All exchanges will be logged and recorded.
- **Task 7.3 – Manage Annual Project Gatherings** (**UBHAM**, ULB) **BY VIDEO CONFERENCE**
  - Once a year all project partners will gather in the form of a (tribal) assembly to discuss the project progress, develop new ideas in producing project outcome, and discuss FCH teaching and progress in general. These gatherings are to mix professional content presentation and management with creativity, fun elements, and general motivation of everyone contributing to the project.

Task 7.1 – Manage and grow associate network

- The intention of the TeacHy project is to establish teaching material that will be employed by universities across Europe. The University Network will assemble all associated university partners wishing to participate in this material but who are not partners of the consortium. It is planned to continuously expand this grouping in order to broaden the base of users of the material developed.

- All these partners are informed via the TeacHy newsletters on the progress of the project and are invited to the Project Gatherings.

The associated network participant list

Vocational Training Partners	
CAMPUS Spa Franchorchamps	Belgium
UJV, Řež	Czech Republic
DVGW	Germany
CISM	Italy
Networking partners	
T.I.M.E.	EU/World
EUREC	EU/Brussels
University Network Partners	
University of Liège	Belgium
University of Louvain la Neuve	Belgium
IEES – Bulgarian Academy of Science	Bulgaria
University of Split (UNIST-FESB)	Croatia
University of Patras, FORTH-ICEHT	Greece
University of Western Macedonia	Greece

University Network Partners	
University Apris-Saclay	France
Hochschule München	Germany
University of Naples, Parthenope	Italy
University of Salerno	Italy
University of Udine	Italy
University of Trondheim/SINTEF	Norway
ZUT	Poland
National Hydrogen and Fuel Cell Centre	Romania
Jozef Stefan Int. Postgrad. School	Slovenia
London Southbank University	UK
FURJ/COPPE, Rio de Janeiro	Brazil
Yonsei University, S. Korea	S.Korea
Wuhan University of Technology	P .R.China
NTU	Singapore

Contacts with the T.I.M.E. network

What is T.I.M.E. Association? (Top International Managers in Engineering)

- Founded in **1989**
- **International network** of technical universities, engineering schools
- It draws its resources exclusively from **annual membership fees**. The annual fee has been set at **2,500 Euros** per.
- T.I.M.E. is governed by an **Advisory Committee** composed of representatives of thirteen elected members, led by a **Management Board** composed of a President, a Vice-President, a Treasurer and a Secretary.
- Secretary General:
  Ms Gwenaëlle GUILLERME
  gwenaelle.guillerme@time-association.org

http://www.timeassociation.org
@TIMEAssociation

T.I.M.E. Top International Managers in Engineering

57 members in **23** countries

https://timeassociation.org/time-members/

T.I.M.E.'s values and goals

- T.I.M.E. promotes **international cooperation**, **excellence** and **academic recognition** in higher education.
- It does so mostly by favoring the **exchange of graduate students** (Master and Doctoral) between its members, via negotiated bilateral exchanges leading to **double degrees**.
- Since the foundation of T.I.M.E., there have been **over 3,000 double degree graduates** from the network. A database is maintained by the Association on its website.

T.I.M.E. GA (Lisbon, IST, Oct,2017)

T.I.M.E. GA (Paris, CentraleSupélec, Oct,2019)

Contacts with the T.I.M.E network

- An e-mail was sent to all T.I.M.E. members at the beginning of the TeacHy project informing them on the objectives of the project and its organization.
- T.I.M.E. members were invited to participate in the Gathering event on 13 November 2018 in Brussels.
- The progress of the TeacHy project were presented during the following T.I.M.E. meetings:
  - General Assemblies:
    - October 12-13, 2017, Instituto Superior Técnico, Lisboa, Portugal
    - October 3-5, 2018, Escola Politécnica -USP, São Paulo, Brazil
    - October 2019, Centrale Supélec, Paris, France
  - Advisory Committees:
    - February 5-6, 2018, Lund university, Lund, Sweden
    - June 30 - July 1st, 2018, TU Darmstadt, Darmstadt, Germany
    - February 7-8, 2019, ETSI Sevilla, Sevilla, Spain
- A dedicated workspace was allocated to the T.I.M.E. members on the Learnify platform: time.learnify

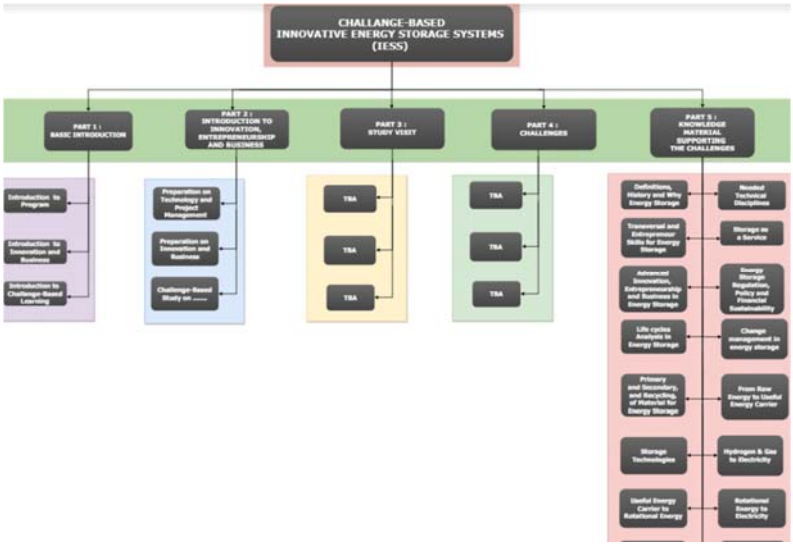
Contacts with the EIT KIC InnoEnergy

What is EIT KIC InnoEnergy ?

- The EIT is an independent EU body that intends to increase Europe's ability to innovate by nurturing entrepreneurial talent and supporting new ideas.
- With KIC InnoEnergy network of partners, connections across Europe, bringing together inventors and industry, graduates and employers, researchers and entrepreneurs, businesses and markets are built.
- The EIT KIC InnoEnergy works in the education to help create an informed and ambitious workforce that understands the demands of sustainability and the needs of industry.

Contacts with the EIT KIC InnoEnergy

- Inside the EIT KIC Innoenergy, Professor Torsten Fransson was coordinating the building of a Micromaster in energy storage. This stackable Micromaster will be available on the Learnify platform (https://innoenergy.learnify.se/l/) and will be open to all persons interested in learning how to store energy. The cooperation with Professor Fransson intends to ensure that hydrogen and fuel cells technologies will be covered by modules in this Micromaster. An example of such a module containing reference to reversible fuel cells is given here: https://innoenergy.learnify.se/l/show.html#Yy0K



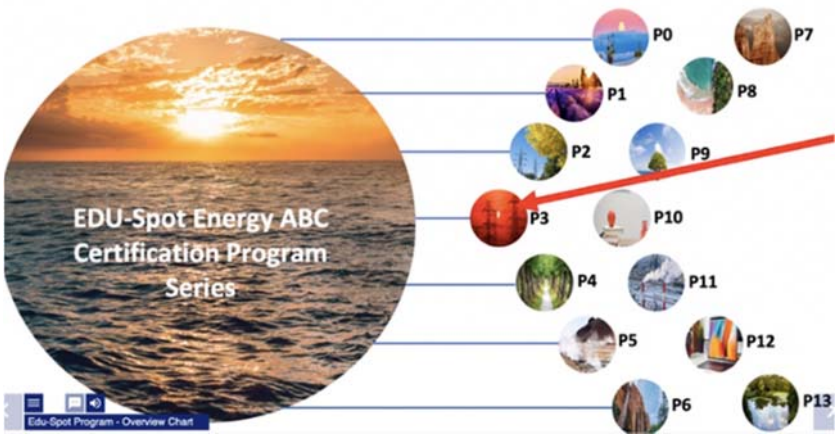
Contacts with Professor Torsten Fransson (KTH)

EUSL-Energy project

- Professor Torsten Fransson is responsible on the European side of the European project entitled “Europe – Sri Lanka Capacity Building in Energy Circular Economy”.
- This project intends to develop a common MSc on-campus program based upon digital online material between 4 universities in Sri Lanka.
- The coordinator of the project is the Open University of Sri Lanka (OUSL) and the partner institutions are the University of Moratuwa (UoC), the University of Peradenyia (UoP) and the University of Ruhuna (UoR).
- This project serves as the basis for two Erasmus+ projects submitted in 2020: EDU-Spot (to be re-submitted) and EDUBCC-Digital (to be supported)

EDU-Spot project

- The full title of this project is “21st Century Flexible, Digital and Online Global Education Towards Renewable and Sustainable Energy Storage Management in a Circular Economy Environment”
- The objectives of this project are:
  - To expand the concept of the EUSL-Energy project to other countries: India and Indonesia
  - To expand the concept towards fully online programmes



EDU-Spot project: P3 Electrochemistry for Energy

Lesson title	ELH	Content/Assement Module title (CM/AM)
L1:Introduction to the certificate "Electrochemistry for energy"	1	Introduction
L2: Basic electrochemistry	25	Thermodynamics, Kinetics, Performances and Design of Batteries
L3: General Introduction to batteries	10	Batteries in the energy context, History of batteries
L4: Primary batteries	25	Types, Uses, Future trends
L5: Secondary batteries	25	Types, Uses, Energy, Power, Charging, Portable, Energy storage, Intelligent, BMS, Future trends
L6: Flow batteries	25	Overview, Vanadium FB, Zn-Br FB, Semi-solid FB, Modelling
L7: General introduction to fuel cells	10	General introduction to fuel cells, FC types, FC operations
L8: Low temperature fuel cells (LTFC)	25	History, principles, PEMFC, AFC, PAFC, DMFC,
L9: High temperature fuel cells	25	Application, Modelling, Hydrid systems, Reversible FCs, Degradation
L10: Case study: batteries for e-mobility	25	Case Study Introduction + 5 tasks

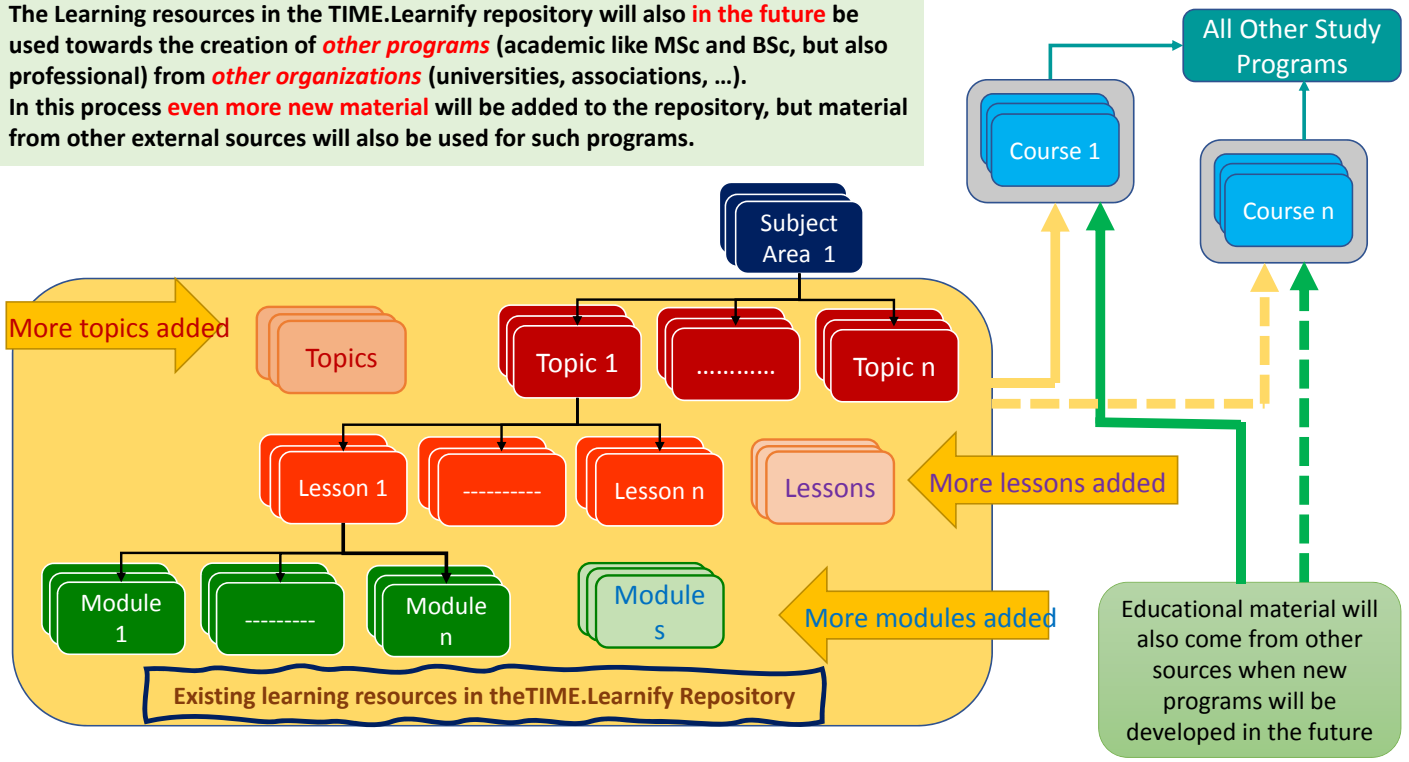
EDU-Spot project composition

- The partners in the EDU-Spot project are: the Open University Sri Lanka (OUSL), University of Peradeniya (UOP), the Odisha State Open University (India), Chhattisgarh Swami Vivekanand Technical University (CSVTU) (Bhilai, India), Indonesian Open University (Indonesia), ITERA (Indonesia), University of Ruhuna (UOR) (Sri Lanka), University of Moratuwa (Sri Lanka), Royal Institute of Technology (KTH) (Sweden), Mälardalen University (MDH) (Sweden), Universiteit Twente (The Netherlands), Riga Technical University (RTU) (Latvia), Universität Stuttgart (USTUTT) (Germany), Université Libre Bruxelles (ULB) (Belgium), EXPLORE Energy Sweden AB (EES), Learnify (Sweden), AudiComPendax AB (Aupx), Politehnica University of Bucharest (UPB) (Romania)

EUBCC-Digital project

- The “Europe-Brazil-Bolivia-Cuba Capacity Building Using Globally Available Digital Learning Modules” project is a “sister” project of the EDU-Spot.
- The countries involved in the project are Brazil, Bolivia and Cuba
- The partners involved in the project are: Universidade de Sao Paulo (USP-Coordinator), Federal University of Rio de Janeiro (UFRJ), Universidad de Pinar del Rio (UPR), Universidad de La Habana (UH), Universidad Central Marta Abreu de Las Villas (UCLV), Universidad Tecnológica de la Habana José Antonio Echeverría (CUJAE), San Simon University (UMSS), Universidad Privada Boliviana (UPBB), Royal Institute of Technology (KTH), Mälardalen University (MDH), Universiteit Twente (UT), Riga Technical University (RTU), Universitat Politècnica de Catalunya (UPC), Université Libre de Bruxelles (ULB), EXPLORE Energy Sweden AB (EES), Learnify, AudiComPendax AB (Aupx), Politehnica University of Bucharest (UPB)

The Learning resources in the TIME.Learnify repository will also in the future be used towards the creation of *other programs* (academic like MSc and BSc, but also professional) from *other organizations* (universities, associations, …).
In this process even more new material will be added to the repository, but material from other external sources will also be used for such programs.



Cooperation with the TeacHy project

- Online modules devoted to hydrogen and fuel cells have been developed on the time.learnify platform in order to be included in the list of available materials for building the education programmes in the two Erasmus+ projects (EDU-Spot and EUBCC-Digital).
- In comparison with the modules developed in the TeacHy project these modules are simplified and give a broad picture of hydrogen and fuel cells uses in energy storage.
- In the future, when the TeacHy modules will be fully ready, discussions will be started with the projects coordinators in order to make reference to the TeacHy Master program and/or to include some of the Teachy modules in the list of reference materials. This could indeed open access to fuel cells and hydrogen technologies to a worldwide community of students.

Thank you for your attention and open to questions!

Jean-Luc Delplancke
delplje@gmail.com

TeacHy gratefully acknowledges the support from the FCH 2JU under contract no. 779730.

Progress: Status and Achievements (3)

- The up-dated associated network participant list contains in addition:

Partner Number	Partner Name	Country
Networking Partners from the T.I.M.E. group		
AN2	University of Queensland	Australia
AN3	Technical University of Vienna	Austria
AN4	Université de Mons	Belgium
AN5	Université Catholique de Louvain	
AN6	Vrije Universiteit Brussel (VUB)	
AN7	Universidade de São Paulo	Brazil
AN8	Universidade Estadual de Campinas	
	Polytechnique Montréal	Canada
AN9	Beihang University	P.R. China
AN10	Xi'An Jiao Tong University	
AN11	Czech Technical University in Prague	Czech Republic
	LUT - Lappeenranta-Lahti University of Technology	Finland
AN12	CentraleSupélec	France
AN13	École Centrale de Lille	
AN14	École Centrale de Lyon	
AN15	École Centrale de Marseille	
AN16	École Centrale de Nantes	
AN17	École des Ponts Paris Tech	
AN18	ENSTA Paris Tech	
AN19	Supaéro (ISAE)	
AN20	RWTH Aachen	Germany
AN21	Technical University of Berlin	
AN22	Technical University of Darmstadt	
AN23	Technical University of Dresden	
AN24	Technical University of Munich	
AN25	University of Hannover	
AN26	Aristotle University of Thessaloniki	Greece
AN27	National Technical University of Athens	
AN28	Budapest University of Technology and Economics	Hungary
AN29	Politecnico di Milano	Italy
AN30	University of Padova	
AN31	University of Trento	

Partner Number	Partner Name	Country
AN32	Doshisha University	Japan
	Yokohama University	
AN33	Keio University	
AN34	Tohoku University	
AN35	N.T.N.U. Trondheim	Norway
AN36	AGH University of Science and Technology, Krakow	Poland
AN37	Wroclaw University of Technology	
AN38	Instituto Superior Tecnico / Technical University of Lisbon	Portugal
AN39	Bauman Moscow State Technical University	Russian Fedemtion
AN40	MIREA Moscow	
AN41	St. Petersburg State Polytechnical University	
AN42	Bauman Moscow State Technical University	
AN43	Universidad de Sevilla/ETSI	Spain
AN44	Universidad Pontificia Comillas/ICAI	
AN45	Universidad Politécnica de Madrid	
AN46	Universitat Politècnica de Catalunya	
AN47	Universitat Politècnica de València	
AN48	Lund University Faculty of Engineering/LTH	Sweden
AN49	Royal Institute of Technology (KTH) Stockholm	
AN50	Istanbul Technical University	Turkey

Brussels, 30 November 2020 (remote)

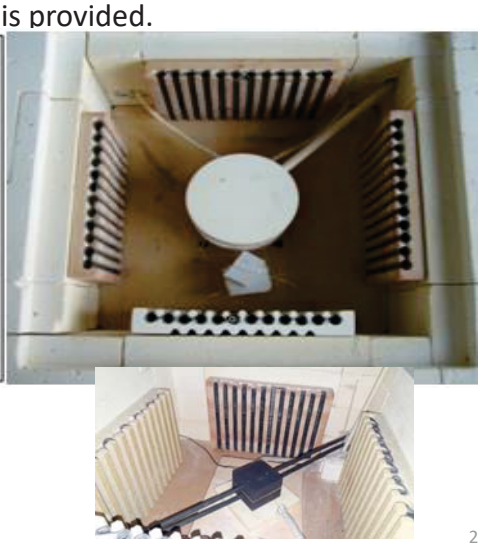
A Lab demo as taught in TEACHY

Massimo Santarelli, Politecnico di Torino (POLITO)

Task 3.1 – Development of 'remote lab' concept

SOFC/SOEC cells or short stack (1-3 cells) characterization

A test station for the analysis of circular and squared planar SOFC/SOEC with capability to characterize different sizes cells (up to 11x11 cm^2) and provide gaseous and liquid feeds. The rig is equipped with an electronic load and an impedance analyzer. On-line gas analysis is provided.

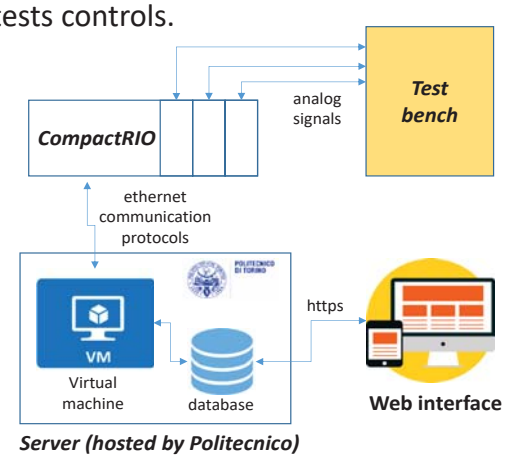


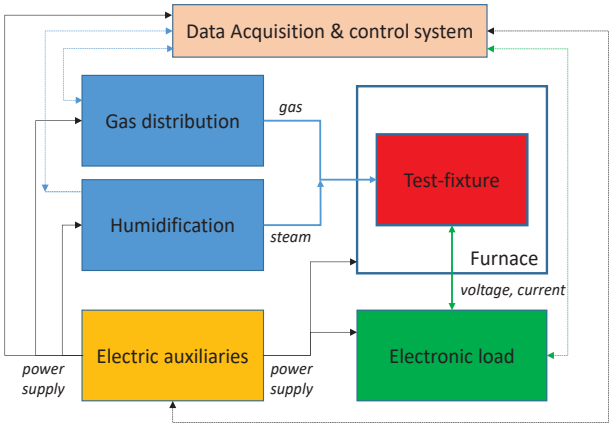
Sealed test-fixture for single cells

Task 3.1 – Development of 'remote lab' concept

SOFC/SOEC single cells or short stack (1-3 cells) characterization

A test station for SOFC/SOEC testing with capability to provide gaseous/steam feeds to cell/short stack and equipped with an electronic load for cell characterization has been interfaced with the web for remote tests controls.





Test-rig (right) and remote control system (left) schematic

Progress: Status and Achievements

Task 3.1 – Development of 'remote lab' concept

- Renovation of experimental apparatus hardware/software

Progress: Status and Achievements

Task 3.1 – Development of 'remote lab' concept

- Experimental apparatus hardware/software

A local PLC (compactRIO, NI) receives the input/output analog signals from/to the test rig through NI modules connected to MFCs (0-5 mV signals) and electronic load (GPIB connection).

The PLC software communicates by Ethernet protocols to a virtual machine - hosted in POLITO servers - where the control software is installed.
A database (also hosted in POLITO servers) stores all the test-rig data in input/output.

compactRIO

GBIP module

Analog I/O modules

Progress: Status and Achievements

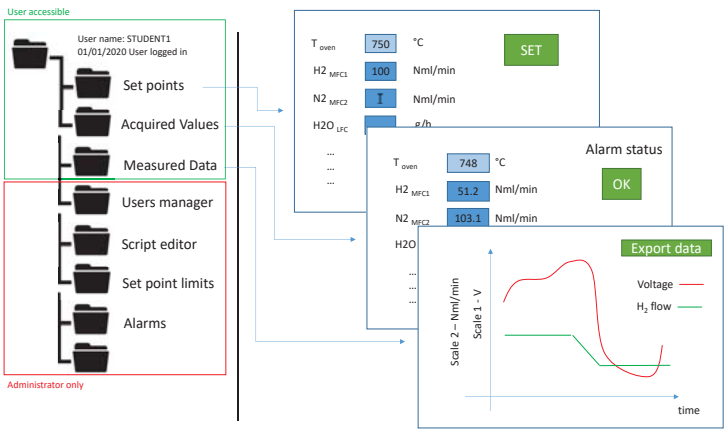
Task 3.1 – Development of 'remote lab' concept

- Remotisation of the test rig

The architecture of the control software has been designed, defining all the variables to be acquired and modified and the control actions to be implemented.

The web user interface will be accessible by PC and smartphones.

Different levels of access have been defined with administrator/user levels, that will allow to control the remote access to the test-rig and to safely operate experiments within safe ranges of the controlled variables.



Progress: Status and Achievements

Task 3.1 – Development of 'remote lab' concept

- Remotisation of the test rig

The remote control software interface has been developed, implementing all the levels of interactions of users with the variables to be acquired/modified on the test-rig (PLC interface) through the virtual machine in POLITO servers. The control interface will be accessible by web anywhere in the world. First beta version release on 27/03/2020.

Structure of web control interface:

- **Experiment management**: administrator level, setup of experiment profiles for group of users
- **Variables management**: administrator level, settings of variables
- **Users Manager**: users (students, other) access managed by administrators (POLITO staff)
- **Graphs and data**: data acquisition, accessible both to admin. and users (users with limitations)
- **Logs, alarms and message**: communications to administrators through POLITO mail system

Progress: Status and Achievements

Task 3.1 – Development of 'remote lab' concept

- Details on remote control architecture

- **Experiment management:** Admins. can create experiment profiles, in which a limited number of variables with restricted range is assigned to each profile. Profiles are generated to be associated to Users (eg. students)

- **Variables management:** management of variables by Admins.; assigned all information to the variables processed in the control system (cRIO address, type: read/write, unit of measure, range, etc.)

- **Users Manager**: levels of control
  - *Root user*: super-user that assigns Administrators access to control system
  - *Administrators* (POLITO staff): full test-rig control and full management of Users
  - *Users* (students or external staff): limited test-rig control in assigned dates and hours, divided in groups (eg. classes) and assigned to predefined experiment profiles (by Administrators)

- **Graphs and data:** access to data visualization/download only for experiment profile variables (for Users) during valid access time. Administrators have unlimited access.

Progress: Status and Achievements

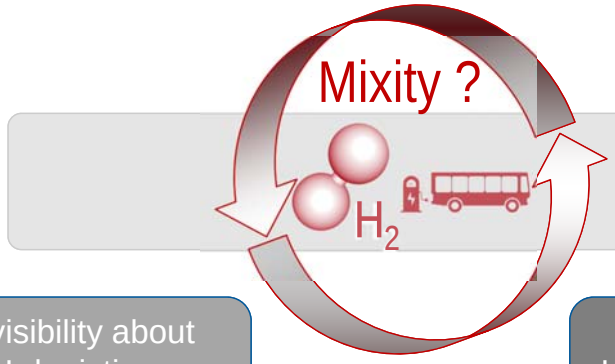
Task 3.1 – Development of 'remote lab' concept

- Renovation of experimental apparatus hardware/software
  - new mass flow controllers (MFCs) → acquisition done
  - new sealed housing for solid oxide cells (SOCs) → acquisition done
  - new data acquisition system (PLC) → acquisition done
  - test-rig rewiring, new PLC connection, safety assessment (ATEX) → acquisition done
  - local software implementation on PLC → acquisition done
- Remotisation of the test rig
  - Remote control interface → under finalization
- To be finalised (some delays are due to covid-19 limiting our activities in the lab)
  - Finalization (test bench ready in the lab and connected to the web) foreseen in January 2021
  - Test of the web interface in February 2021
  - Remote test bench available for use from March 2021

What's happening at the STIB about hydrogen?

- STIB is the single public transport operator of the Brussels-Capital Region (about 850 buses)
- Since mid 2019, a STIB R&D program on H_2 is ongoing ...
- Purpose:
  - > Analyse if hydrogen technology could be a solution for the huge lack of flexibility of (conventional) battery electric buses & heavy vehicles
  - > If so, how and to what extent should this technology be deployed ?
  - > Should we use the HRS of Zaventem (JU FCH SWARM project) ?

Probable future: mix between the 2 technologies



Today, the visibility about Green H_2 logistic development remains limited but should be improved during this starting decade

How far and how concretely are we going to organise that bus mixity?

STIB starts concretely with a limited experience

- A "laboratory" to learn how to tame this technology: the First Stage
- To operate a H_2 bus for 2 years and to supply it with compressed H_2

1 bus that will be 100% ready for our customers

1 mobile fueling station (example)

Preparing the field

- Trainings of people
- Call for volunteers
- Very limited maintenance
- Security/Safety
- Application of standards
- …
- **Social Acceptance**

We start with limited experience

Training needs to be provided by STIB Academy: +/- 70 people … with Teachy/ULB support ?

Before the arrival of the buses

+/- 30 drivers

5 people for the OCC

5 people from the fire department

+/- 10 people for maintenance

10 people for troubleshooting and field support

5 people as « train the trainers »

This training process will be the operational basis for any future expansion of H2 technology.