

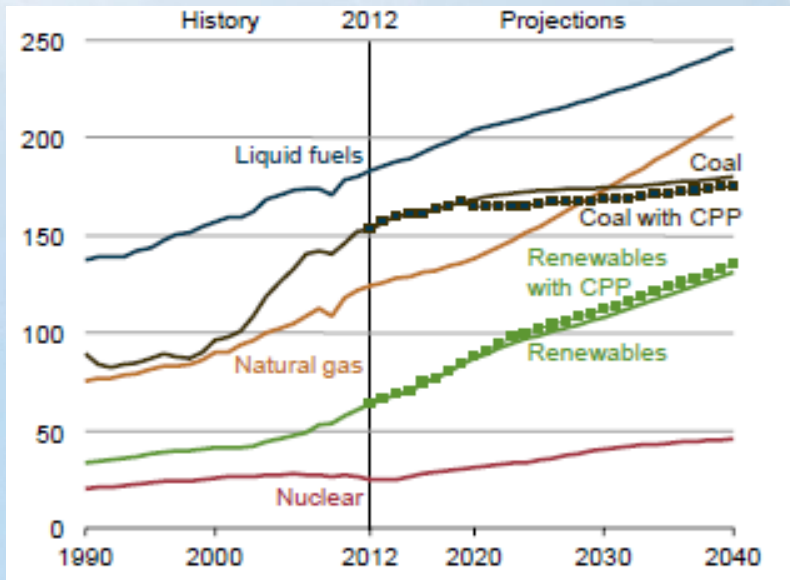


TRAINING TECHNICIANS IN THE FIELD OF HYDROGEN & FUEL CELLS

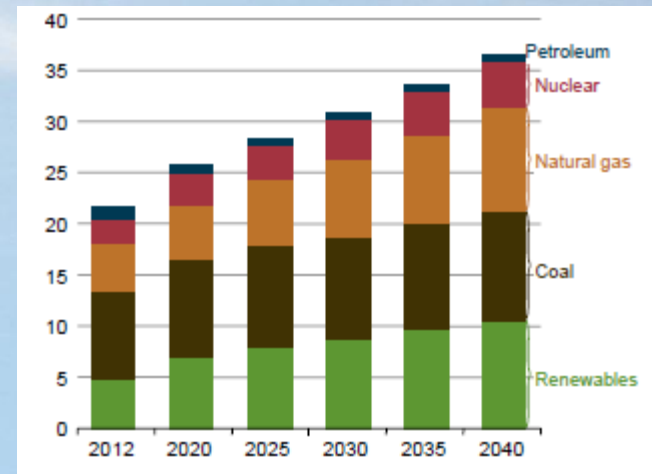
PV Aravind
Assoc. Professor, TU Delft



World Energy Consumption by 2040



World Energy Consumption by 2040,
Quadrillion Btu

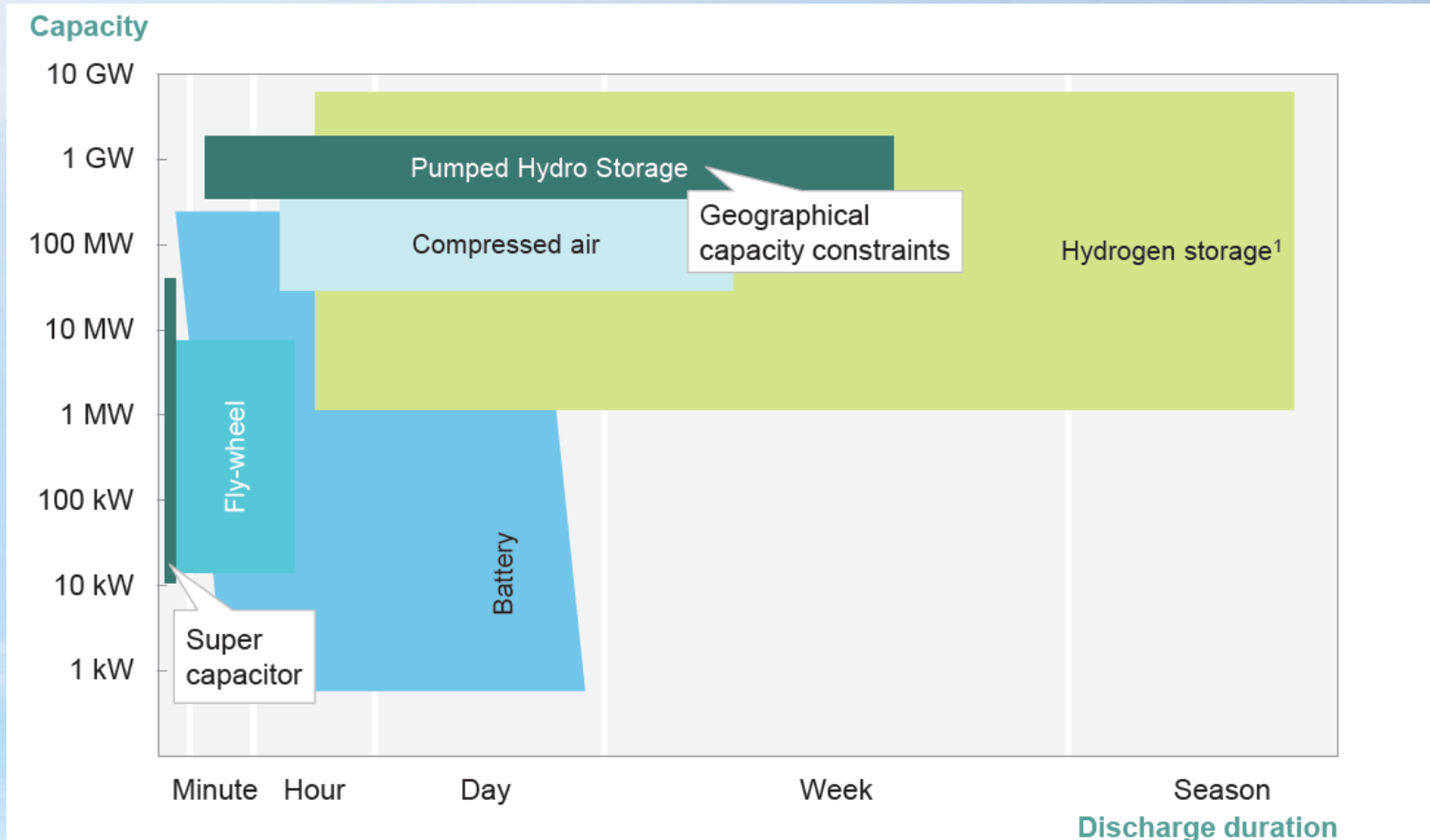


World Electric Power Production by 2040,
Trillion kilowatt-hours

International Energy Outlook 2016, US EIA

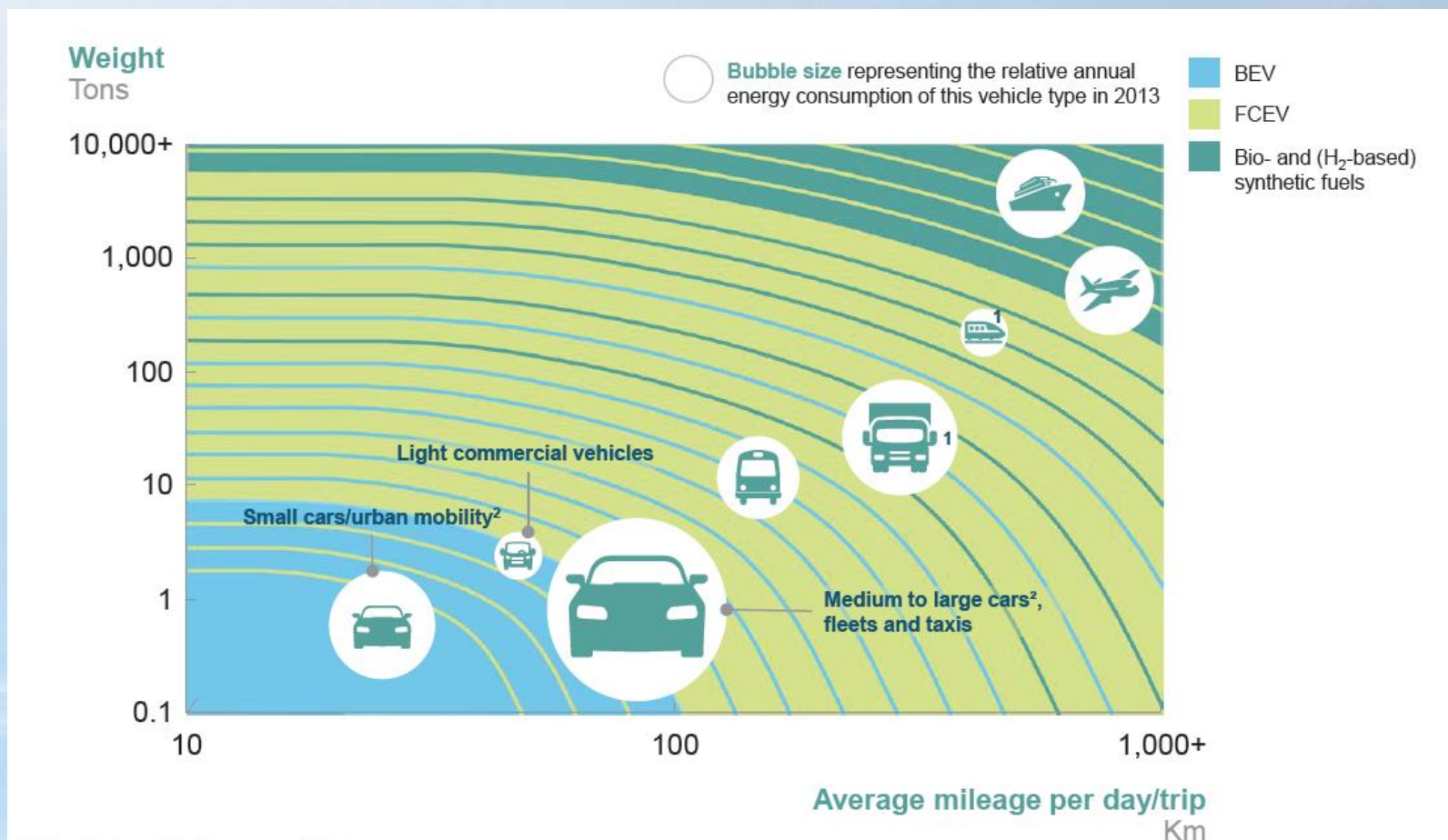


Hydrogen for Energy Storage



How hydrogen empowers the energy transition, Hydrogen Council 2017

Transportation Options

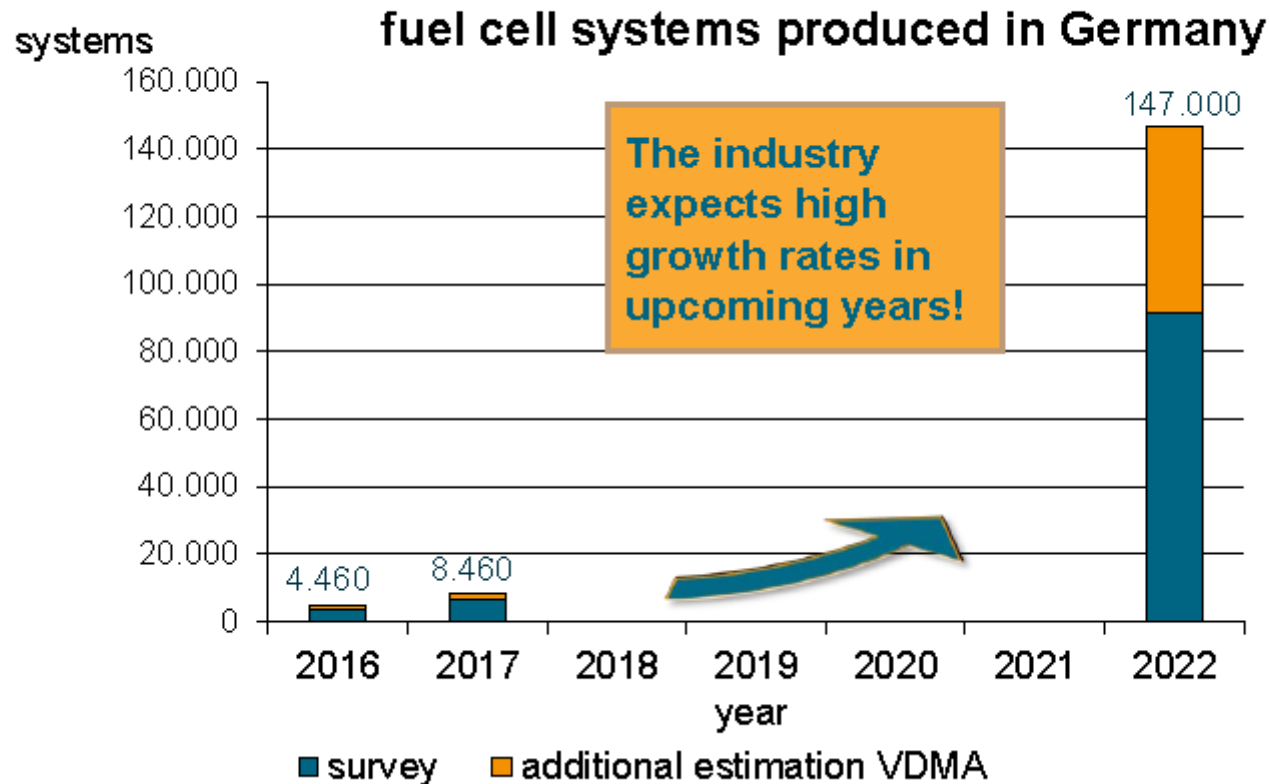


How hydrogen empowers the energy transition, Hydrogen Council 2017



In Germany

Units per year – fuel cell systems annually produced in Germany



VDMA Fuel Cell Survey 2017



Growth in Industry: The need for Trained Manpower

- ⚙ Large number of technicians might be needed
- ⚙ Limited training opportunities
- ⚙ Not many facilities for practical training
- ⚙ Not many trainers
- ⚙ What is the solution?
- ⚙ An innovative approach based on shared labs, serious games, online training and tutoring



KNOWHY- An Introduction

The primary objective of KnowHy project is to create a sustainable training offer targeting professionals. The features of this training program are:

- ⚙ Specific focus on market roll-out applications
- ⚙ Comfortable online cum hands on format for active technicians
- ⚙ Practical training and serious games complementing the lessons
- ⚙ Low admission fees
- ⚙ Easily adaptable to new applications
- ⚙ A legal entity to continue to offer the courses



What We Offer

- ⚙ Courses in **7 different languages** viz. *Dutch, French, English, Spanish, Italian, German & Portuguese* and in multiple countries.
- ⚙ Courses available in **E-learning** format
- ⚙ Training a minimum number of 1000 people
- ⚙ Five different courses with one core course module design
- ⚙ Continuation of the training without any subsidies after the project ends

5 specializations on the following topics:

- ⚙ Automotive and Material Handling Sector
- ⚙ Hydrogen Production and Handling
- ⚙ Micro Fuel Cells
- ⚙ CHP and microCHP
- ⚙ Fuel Cells based Generators (APU and Backup Power)



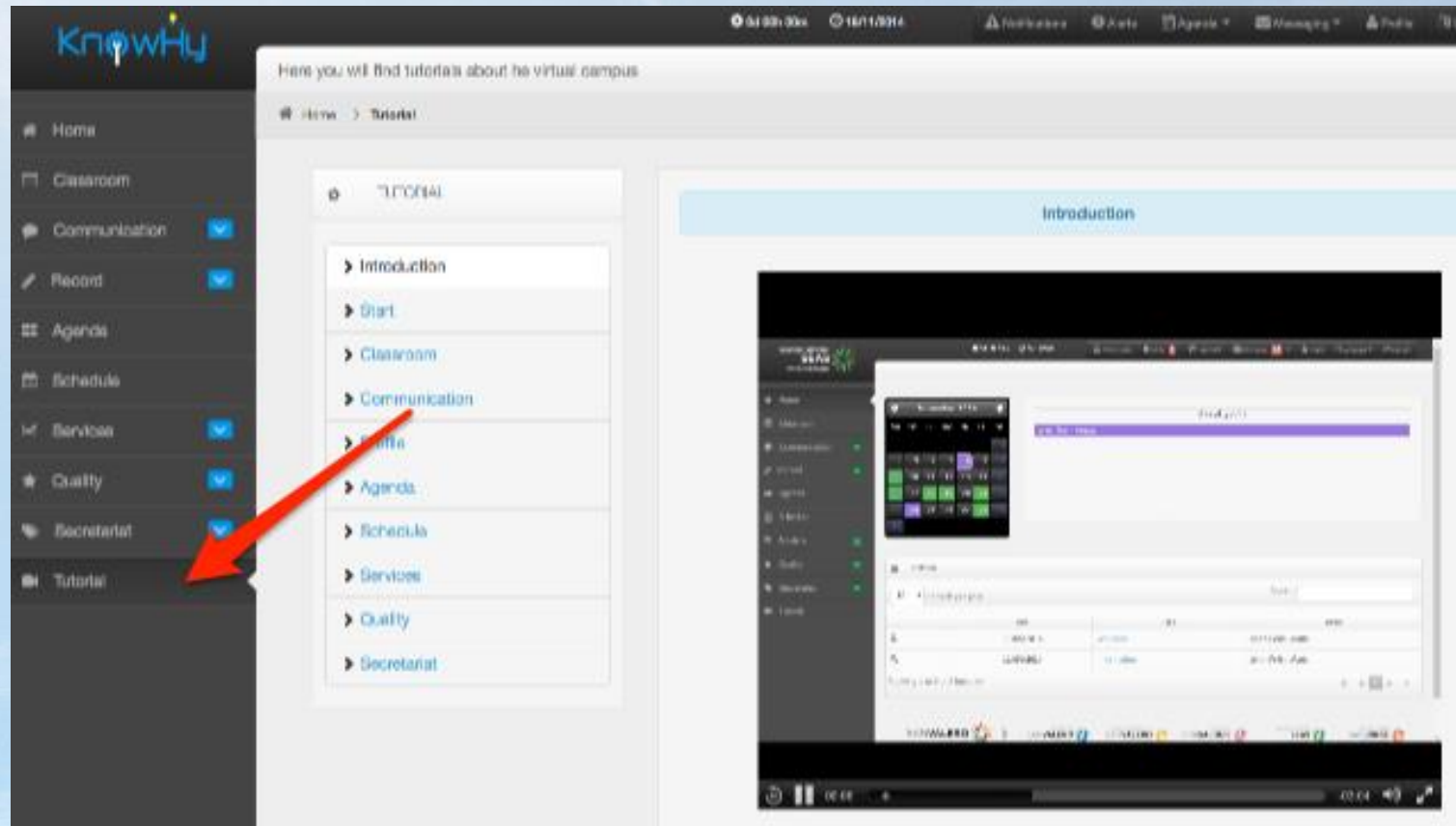
What We Offer

Ease of accessibility



What we offer

E-Learning & 3D Games



KnowHy Practical Core module

- ⚙ Includes an electrolyzer for H₂ production, solar panel for power supply and a fuel cell.
- ⚙ Experiments such as effect of light intensity on H₂ production in electrolyzer
- ⚙ Problem solving
 - ⚙ Leak in tube
 - ⚙ Disconnect wires
 - ⚙ "Natural" sabotage: air in system



COURSE OUTLINE

Fuel Cell Fundamentals (Core module)

- ⚙ Introduction to Hydrogen and fuel cells
- ⚙ Cell and stack performance
- ⚙ Tools
- ⚙ Installation, Maintenance & Troubleshooting
- ⚙ Safety



COURSE OUTLINE

Automotive and Material Handling Sector

Enabling technicians to adapt to the latest trends in the transport scenario

Automotive



Material Handling



COURSE OUTLINE

Hydrogen Production and Handling

To prepare technicians in the upcoming hydrogen filling stations



COURSE OUTLINE

CHP and microCHP

One of the major players in the fuel cell market provided a CHP unit



COURSE OUTLINE

Fuel Cell based Generators (APU and Backup Power)

Another objective is to train technicians to handle fuel cell based generators



COURSE OUTLINE

Micro Fuel Cells

An emerging area of application is micro fuel cells



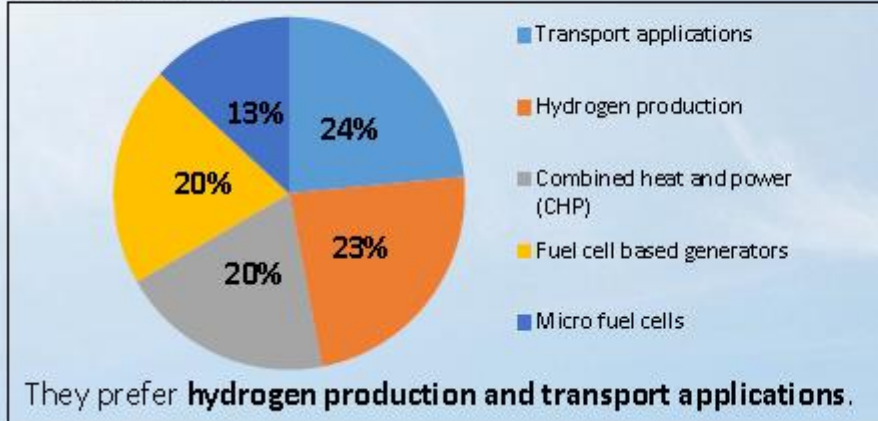
KnowHy Trainings

- ⚙ 700+ students enrolled
- ⚙ Students enrolled in core module:
 - ⚙ Italy: 240+ students enrolled
 - ⚙ Spain: 150+ students enrolled
 - ⚙ Portugal: 80+ students enrolled
 - ⚙ Several students enrolled in UK, Netherlands, Belgium Germany and France
- ⚙ Roughly one third finished and many are continuing



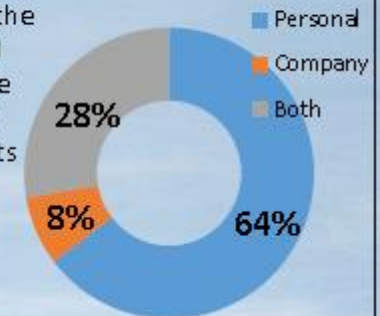
KnowHy: Student response

Field of interest:



Motivation:

Motivation force to attend the course: Only 8% of the students have indicated that the company where they work was the only motivation. The students are **highly motivated**.



- ⚙️ KnowhyHy courses appreciated by students(score: 9.0)
- ⚙️ Based on the response from students who have completed the courses
- ⚙️ Positive response from industry
- ⚙️ Tutors are well motivated
- ⚙️ Teachers give high importance to practical sessions



Expectation indicators: students & teachers

	EXPECTATION	SATISFACTION
	Importance	Quality
STUDENTS	Serious games: 6.9 Online platform: 8.1 Practical sessions: 6.7 Teachers: 6	Serious games: 8.6 Online platform: 8.75 Practical sessions: 9 Teachers: 8.63
TEACHERS	Serious games: 6.4 Online platform: 8 Practical sessions: 8.7 Teachers: 7.3	Serious games: 5.5 Online platform: 7 Practical sessions: 9 Teachers: 7
	Importance	Importance



Final Remarks

- ⚙ All the modules prepared and translated.
- ⚙ Courses offered in all the seven participating countries
- ⚙ Several hundred students being trained- haven't reached the target -1000
- ⚙ Highly satisfied students- limited number of companies we have contacted also indicated satisfaction
- ⚙ Project period is extended and is expected to end in February 2018
- ⚙ A joint venture might be formed to follow up



THANK YOU

