COSMHYC

COSMHYC
INNOVATIVE H2 COMPRESSION

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Programme Review Days 2018

Brussels, 14-15 November 2018

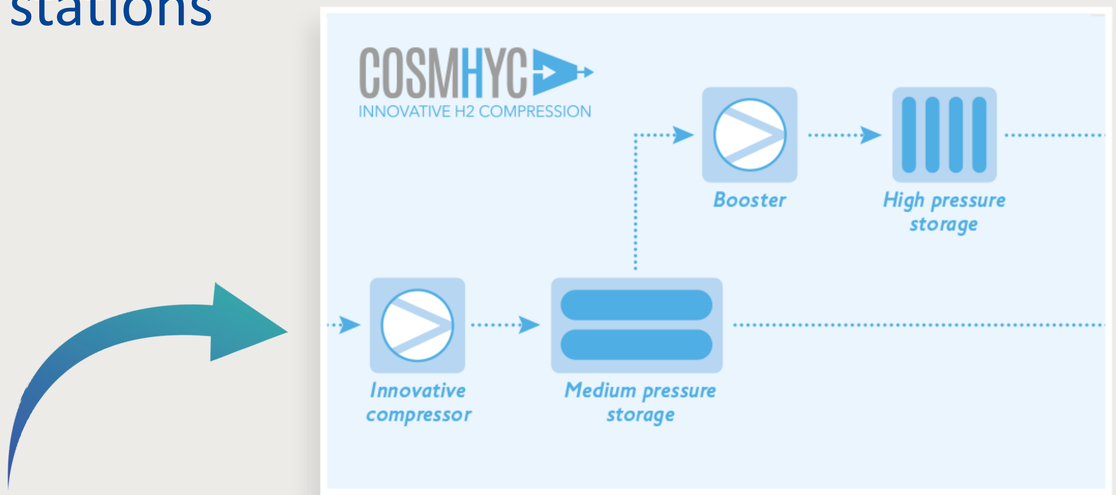
PROJECT OVERVIEW

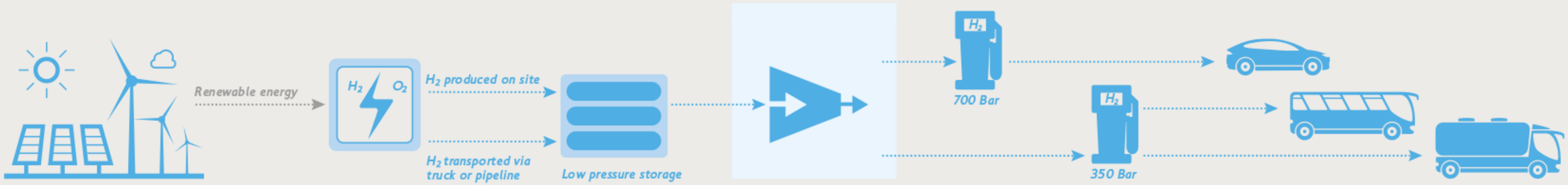
- Call year: 2016
- Call topic: FCH-01.8-2016: Development of innovative hydrogen compressor technology for small scale decentralized applications for hydrogen refueling or storage
- Project dates: 01/2017-09/2020
- % stage of implementation 01/11/2018: 50%
- Total project budget: 2 496 830 €
- FCH JU max. contribution: 2 496 830 €
- Partners: EIFER (DE, Coordinator), MAHYTEC (FR), Nel Hydrogen (DK), Steinbeis 2i (DE), LBST (DE)

PROJECT SUMMARY

COSMHYC: COmbined hybrid **S**olution of **M**ultiple **HY**drogen **C**ompressors for decentralised energy storage and refuelling stations

Objectives: combining a conventional compressor with an innovative compression technology, in order to reduce the overall compression costs & reduce the noise pollution





PROJECT SUMMARY

COSMHYC: COmbined hybrid **S**olution of **M**ultiple **HY**drogen **C**ompressors for decentralised energy storage and refuelling stations

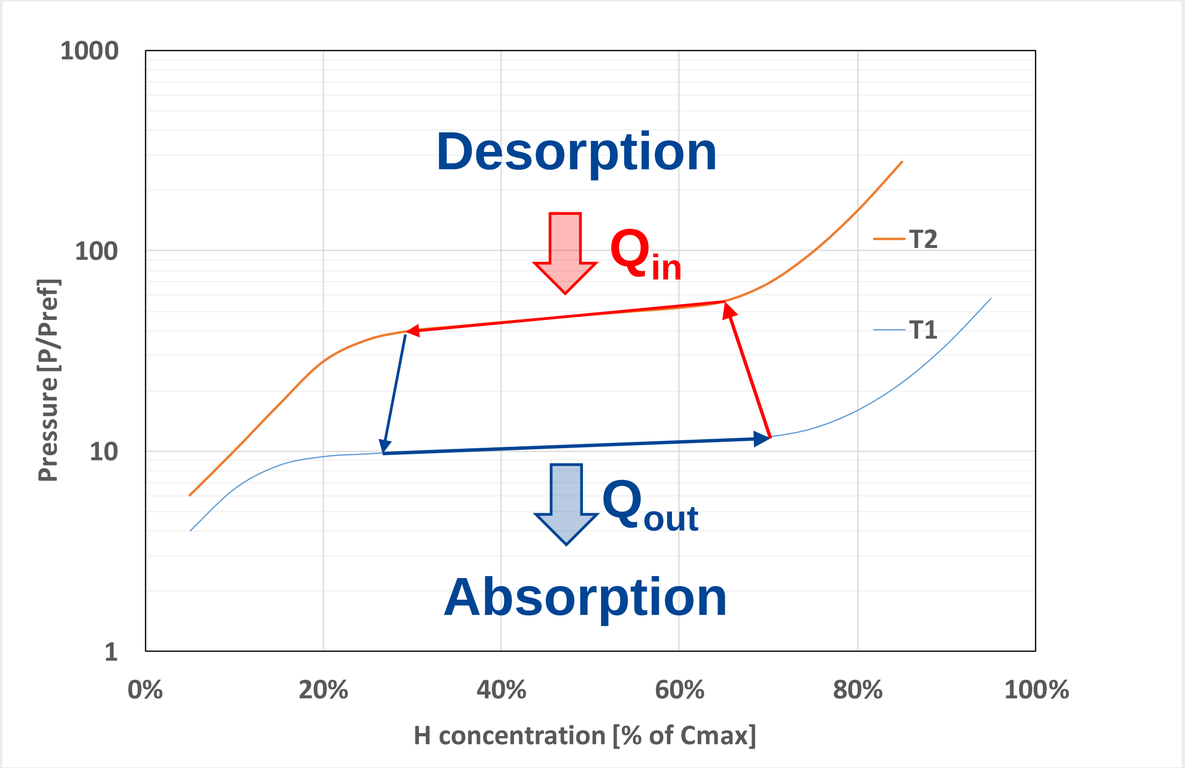
Objectives: combining a conventional compressor with an innovative compression technology, in order to reduce the overall compression costs, by:

- Reducing investments costs down to less than **2000 €/(kg*day)** *(SOA ~3000 €/(kg*day) for innovative compression technologies)*
- Reducing energy consumption to **<6 kWh/kg** (*SOA: 3-12,5 kWh/kg for innovative compression technologies depending on pressure)*
- Reducing maintenance costs by **<50%** compared *(SOA: >5% of CAPEX)*
- Improving life time by decreasing the degradation down to **1% per year** *(SOA: 20% degradation in 1000h)*

PROJECT PROGRESS – Aspect 1

Innovative technology : metal hydride compression

- Heat driven absorption/desorption cycles
- Pressure increase thanks to temperature variations
- No moving parts: reduction of maintenance costs, reduction of noise disturbance
- (Almost) no electricity consumption if a heat source is available
- Main issue: utilization of critical raw materials



PROJECT PROGRESS – Aspect 1 – achievement to date

FCH 2 JU 5th techno-economic objective: “reduce the use of the EU defined Critical raw materials”

- Reason 1: be independent from non-European countries for material sourcing
- Reason 2: reduce production costs by employing unexpensive raw materials

Actions performed

- 11 material compositions were preselected, developed, tested and analysed
- Some of the preselected materials demonstrated appropriate characteristics for compression and are even better than comparable materials with raw materials !

SOA: UTILISATION OF CRITICAL RAW MATERIALS

33%
01/2017: NEW CONCEPT ENABLES ~1/3 REDUCTION

66%
09/2017: NEW MATERIALS ENABLE 75% REDUCTION

100%
03/2018: NEW MATERIALS ENABLE 100% REDUCTION

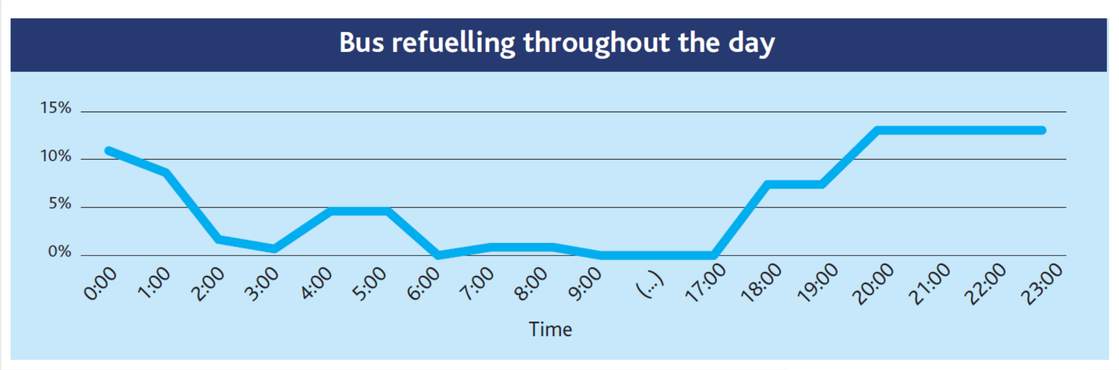
PROJECT TARGET: 0% CRITICAL RAW MATERIALS
TARGET REACHED

PROJECT PROGRESS – Aspect 2

New booster concept for efficient quality of service

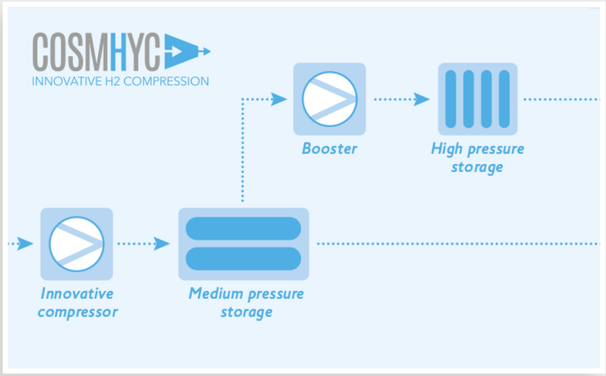
Motivation:

- Refueling profiles of vehicles may vary significantly during the day with peak / off peak demand times
- H2 storage at intermediary pressure is significantly cheaper than at high pressure
- Designing innovative compressor for base load is less expensive than for peak load
- Boosters can work very efficiently for low compression ratios
- Issues: life time, noise, flow rate



Source: FCH - New Bus Fuel 2017

NewBusFuel



PROJECT PROGRESS – Aspect 2 – achievement to date

New booster concept for efficient quality of service

Actions performed :

- New design developed enabling to increase capacity, reduce noise disturbance and reduce production costs by **25%**
- New materials & production processes developed enabling better efficiency and an improved life time of core components by **+100%**

PROJECT START: PROOF OF CONCEPT (TRL3)

50%

03/2018: DESIGN & STUDIES FINALISED CONSTRUCTION STARTED

90%

09/2018: PROTOTYPE READY, PRELIMINARY TESTS TO START SOON

PROJECT TARGET: FULLY OPERATIONAL PROTOTYPE (TRL 5)

PROJECT PROGRESS – Other activities ongoing

System integration of innovative compressor:

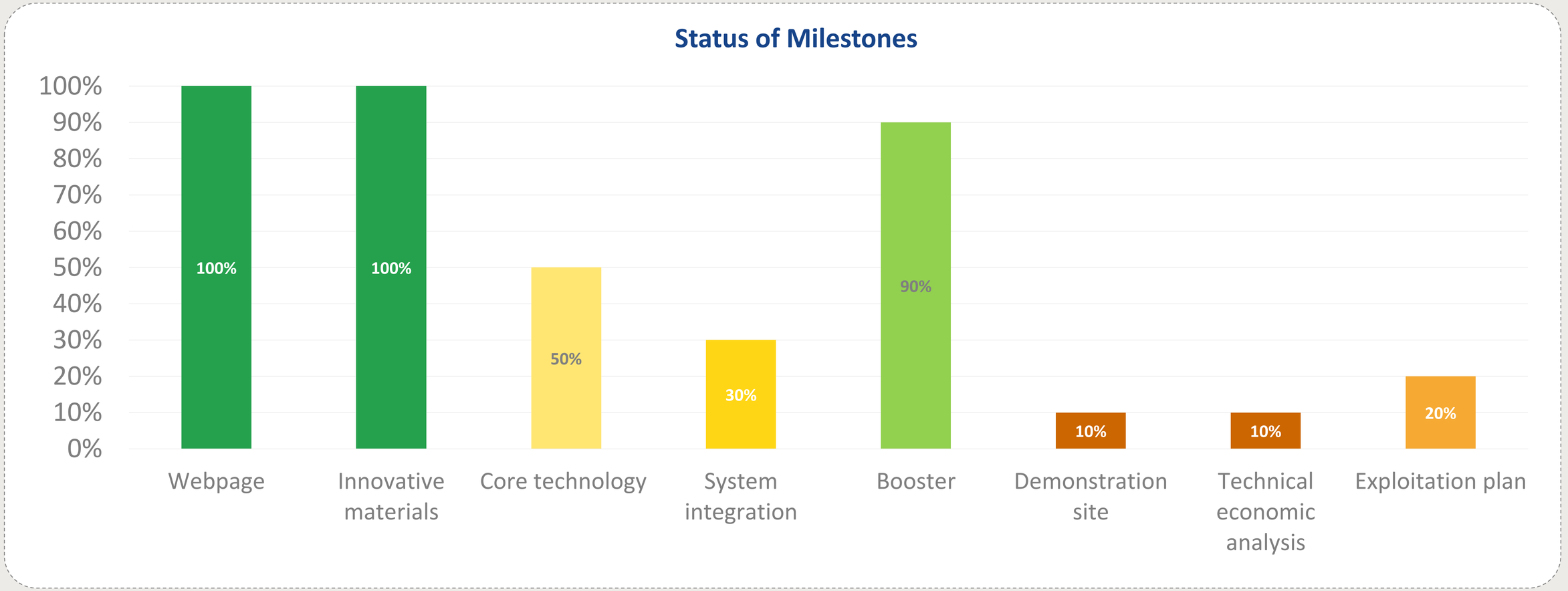
- Design currently being finalized
- Safety studies ongoing

Business case & customer value proposition:

- Identification and definition of three prototypical hydrogen compression applications performed
- Description and characterisation of system requirements for prototypical applications performed
- Techno-economic evaluation to be performed at the end of the project

Summary of COSMHYC achievements

Status of the project in November 2018



Communications Activities

A **communication strategy** was developed and is currently being implemented

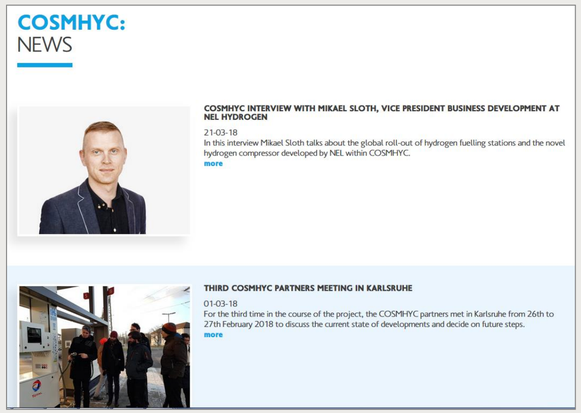
⇒ Webpage developed and regularly updated

⇒ Web presence on Twitter and LinkedIN created and regularly updated

- > 800 visitors on Twitter
- > 500 professionals linked with COSMHYC on LinkedIN

⇒ 8 project news, 3 interviews realized

⇒ Project video under development

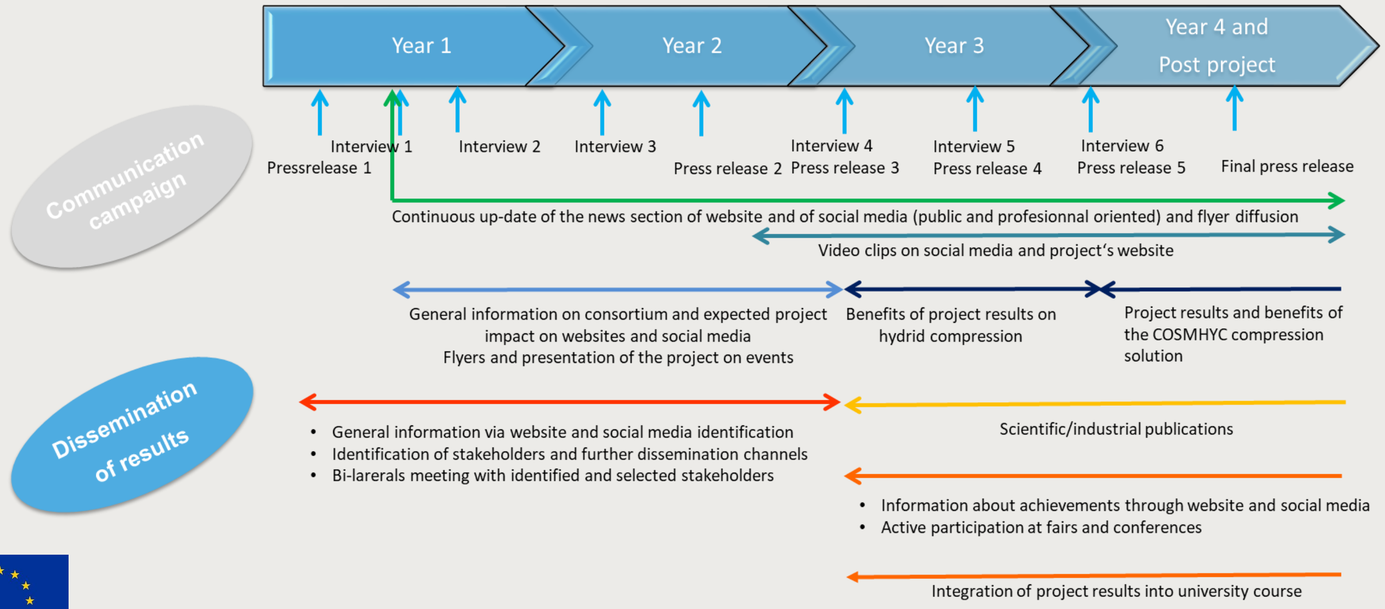


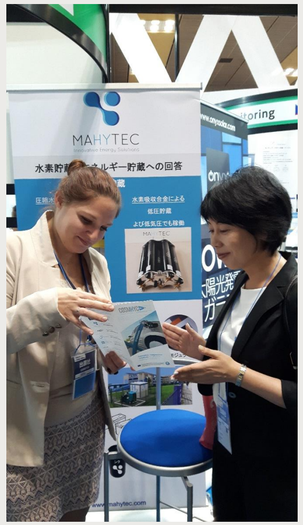
Dissemination Activities

A **dissemination & exploitation strategy** was developed and is being implemented:

⇒1st draft of exploitation strategy developed. 1 dedicated workshop implemented

⇒Dissemination strategy defined: Target groups, messages, time schedule, potential diffusion channels. Dissemination flyers developed





Dissemination action of MAHYTEC at Osaka Energy Week

Risks and Challenges

1st challenge encountered: change in the location of the planned long term tests due to a relocation of the factory of one partner. Problem solved by addressing early the problem and finding a new location for the tests. (Project amendement was proposed and accepted)

2nd challenge encountered: difficulties to identify innovative materials with no critical raw materials. Problem solved by performing more literature review, doing more simulations and more experiments in laboratories of the partners. Appropriate materials were found

Upcoming risks and challenges:

- Risk of delays in the construction of the prototype. Mitigation strategy: different tasks were started in parallel as soon as possible, and regular assessment of advancement is performed.
- Risk of bad data quality during monitoring phase. Mitigation strategy: dedicated task for the development of a robust monitoring concept with appropriate backup strategies
- Risk of change in regulative framework. Mitigation strategy: active watch and participation in national and international working groups

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

Thank you for your attention !

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Backup: SOA sources

SOA costs of innovative compressors: http://www.phaedrus-project.eu/userdata/file/Presentations/PHAEDRUS%20presentation%20at%20Program%20Review%20Days%20Nov%202015%20by%20HyET%20Peter%20Bouwman.pdf

SOA energy: https://www.hydrogen.energy.gov/pdfs/review15/pd048_lipp_2015_o.pdf & https://www.hydrogen.energy.gov/pdfs/review17/pd138_johnson_2017_o.pdf