

# BayFOR

## Bavarian expert on EU – funding advisory services

Greek-Bavarian cooperation

for hydrogen technologies

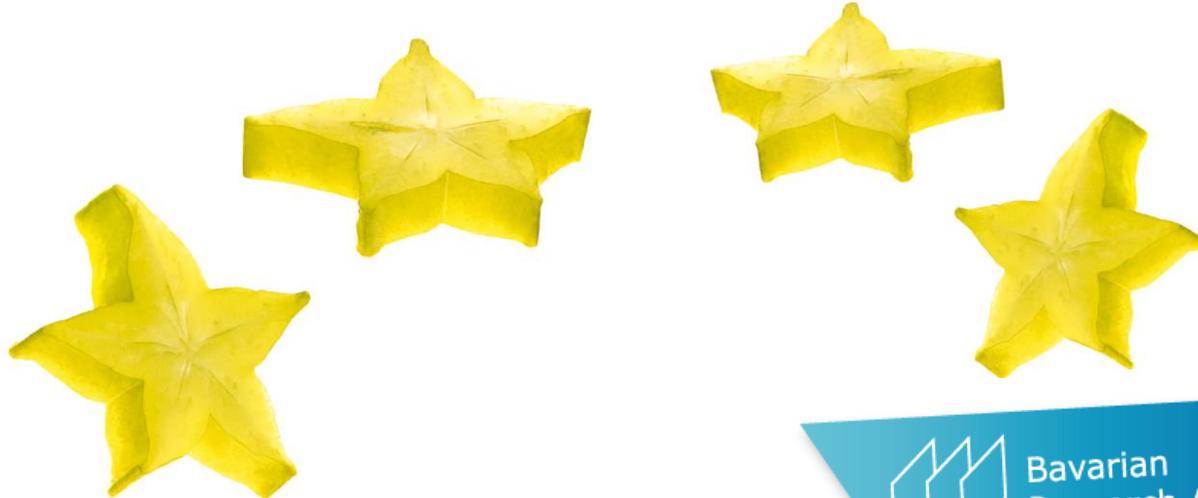
*JU clean Hydrogen + clean Aviation*

Dr. Panteleïmon Panagiotou

Head of Unit

Information & Communication Technologies |

Engineering & Natural Sciences





## 1. EU-funds

## 2. Clean Hydrogen

## 3. Clean Aviation



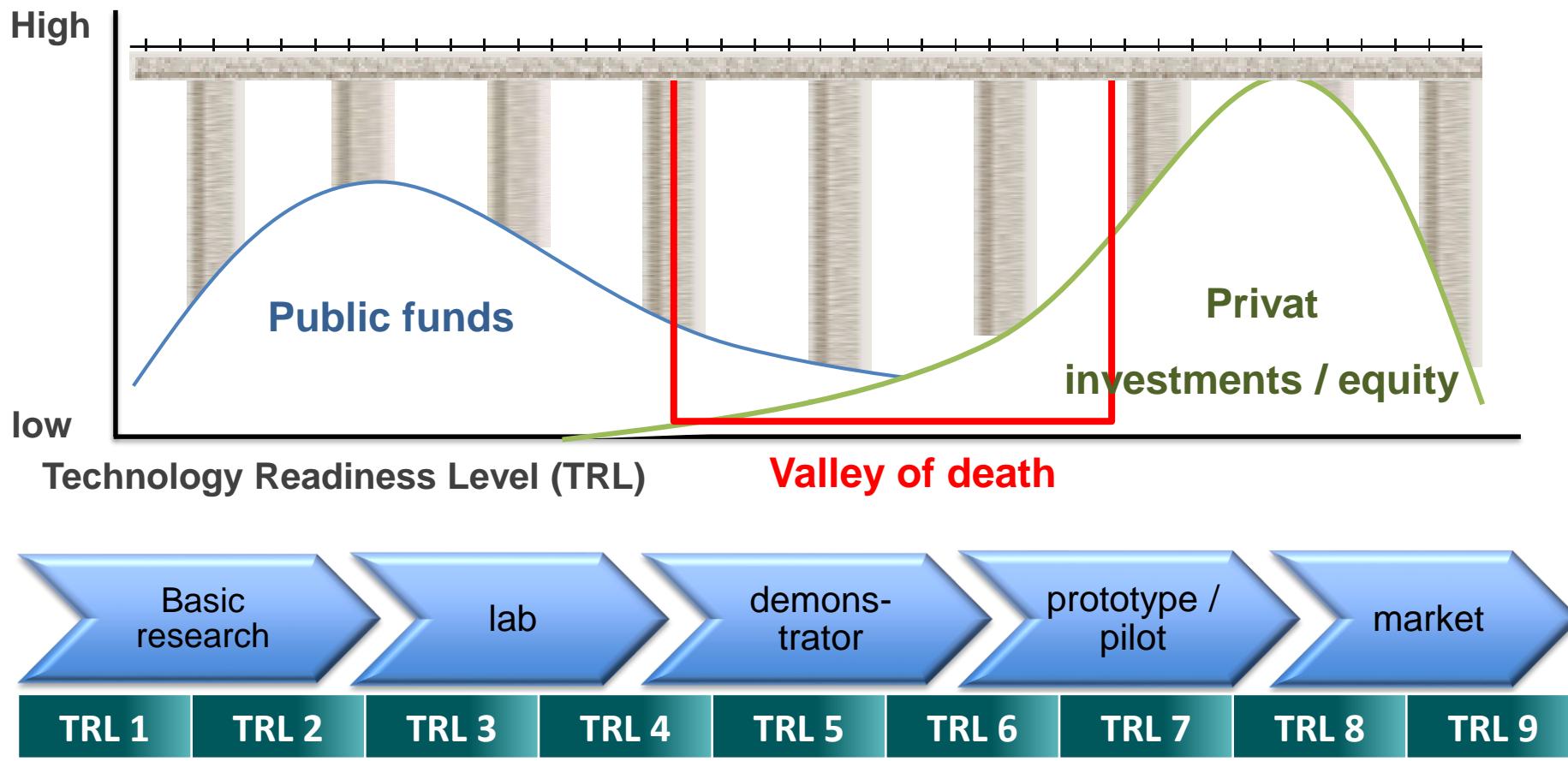
## EU-funds on Hydrogen

- Funds on IPCEI on Hydrogen:
  - initiated dec 2020,
  - participating 22 EU-MS + NO,
  - up to 400 projects in Europe (62 projets with funds of 8 bio. €)
  - on generation, transport, industrial use and mobility
- Funds on EU-Partnership within Horizon EUROPE, mainly in **Clean Hydrogen....**
- Funds on hydrogen topics even in other EU-Partnership in Horizon EUROPE
- Membership in [European Clean Hydrogen Alliance \(ECH2A\)](#) and adoption of [European Hydrogen Strategy](#) supports your proposal



Bavarian  
Research Alliance

# HORIZON EUROPE – closing the funding gap





# Horizon EUROPE (HEU) 2021 – 2027 / 95,3 bn €

## Pillar I

Excellence Science

European Research Council (ERC)

Marie-Sklodowska-Curie action (MSCA)

Research infrastructures

## Pillar II

Global Challenges and European Industrial Competitiveness

- Cluster
1. Health
  2. Culture, Creativity and inclusive society
  3. Civil security for society
  4. Digital, Industry and Space
  5. Climate, Energy and Mobility
  6. Food, Bioeconomy, natural Ressources, Agriculture and Environment

Joint Research centre

## Pillar III

Innovative Europa

European Innovation council (EIC)

European innovation ecosystem

European Institute of Innovation and Technology (EIT)

No thematical area given

Bottom-up

low TRL

Basic research

thematical area given

Top-down

high TRL

Industry, close-to-market

No thematical area given

Bottom-up

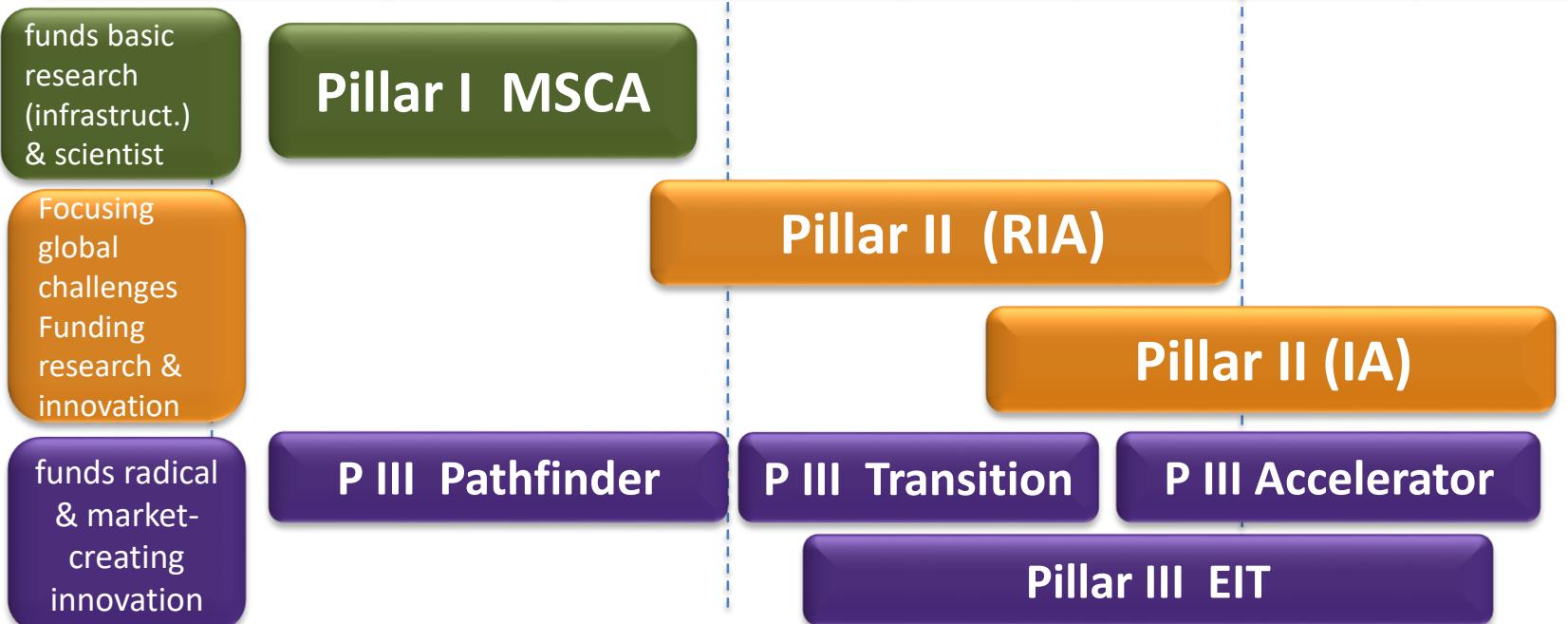
overarching TRL

SME, Start-up, RTO, uni



## HORIZON EUROPE – TRL correlation to pillars I - III

TRL	1	2	3	4	5	6	7	8	9
Definition	Basic principles observed	Technology concept formulated	Experiment. Proof of concept	Technology validated in lab	Technology validated in relevant environment	Technology demonstrated in relevant environment	Prototype demonstration	System complete and qualified	System proven in operational environment





## 1. EU-funds

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# Clean Hydrogen Partnership (Joint Undertaking) - Background

The JU is a unique **public private partnership** supporting research and innovation activities in hydrogen technologies in Europe.

The **three members** of the JU are the **European Commission**, **Hydrogen Europe** and **Hydrogen Europe Research**



Hydrogen  
Europe



Hydrogen Europe

Research

Funded topics are based on the **Strategic Research and Innovation Agenda (SRIA2)** 2021-2027 of the JU.

It covers the duration of **Horizon Europe** and identifies the key priorities and the essential technologies and innovations required to achieve the European **climate neutrality goal** by producing noticeable, quantifiable results towards the **development and scaling up of hydrogen applications**.





# Clean Hydrogen Partnership - Call for proposals 2022

Publication date	01 March 2022
Opening date	31 March 2022
Deadline model	Single-stage
Deadline dates	<del>31 May 2022, 17:00 (CEST), 179.5 Million €</del> <b>20 September 2022, 17:00 (CEST), 121 Million €</b>
Funding programme	Horizon Europe <u>Clean Hydrogen Joint Undertaking</u>

## 15x topics available

- 4x – RHP: Renewable Hydrogen Production
- 5x – HSD: Hydrogen Storage and Distribution
- 1x – TRA: Transport
- 1x – H&P: Heat and Power
- 2x – CC: Cross-cutting
- 2x – HV: Hydrogen Valleys



# Clean Hydrogen Partnership - Call for proposals 2022 (i)

RHP: HORIZON-JTI-CLEANH2-2022-01-04

Design for advanced and scalable manufacturing of electrolyzers

MRL 4 → 5 // 2 (of 4) Mio. € // RIA

novel processes and **surface coating**; improvement in **manufacturing** and **automation**; recyclability

RHP: HORIZON-JTI-CLEANH2-2022-01-05

Scaling up of cells and stacks for large electrolyzers

TRL 3 → 5 // 6 (of 6) Mio. € // RIA

larger area **cells/stacks** components; adequate **manufacturing** quality for high power systems

RHP: HORIZON-JTI-CLEANH2-2022-01-08

Integration of multi-MW electrolyzers in industrial applications

TRL 6 → 8 // 18 (of 18) Mio. € // IA // JU partner mand.

**Demonstrate** reliable operation; Gain operational **experience**; techno-economic **analysis**; Assess **legislative**...

RHP: HORIZON-JTI-CLEANH2-2022-01-10

Demonstrating offshore production of green hydrogen

TRL 4 → 7 // 20 (of 20) Mio. € // IA // JU partner mand.

**Determination** of the long-term performance; Evaluation / **demonstration** of operational, inspection and maintenance; Building upon existing experience

HSD: HORIZON-JTI-CLEANH2-2022-02-01

Compatibility of Distribution non-steel metallic gas grid materials with hydrogen

TRL 3 → 5 // 2.5 (of 2.5) Mio. € // RIA

**De-risking** of business case for repurposing of existing European gas grids; increased confidence in **safety**; **harmonised** guidelines



# Clean Hydrogen Partnership - Call for proposals 2022 (ii)

HSD: HORIZON-JTI-CLEANH2-2022-02-04

Ammonia to Green Hydrogen: efficient system for ammonia cracking for application to long distance transportations

TRL 3 → 5 // 3 (of 3) Mio. € // RIA

Develop a range of **hydrogen carriers** used commercially to **transport and store** H<sub>2</sub>; low hydrogen carrier delivery cost and specific energy consumption

HSD: HORIZON-JTI-CLEANH2-2022-02-05

Efficient system for dehydrogenation of liquid organic hydrogen carriers for application to long distance transportations

TRL 3 → 5 // 3 (of 3) Mio. € // RIA

research on carrier **cycling performance**, chemistries, catalysis and reactors; **Develop** a range of hydrogen **carriers**; low hydrogen carrier delivery **cost** and specific energy consumption

HSD: HORIZON-JTI-CLEANH2-2022-02-06

Development of large scale LH2 containment for shipping

TRL 2 → 5 // 6.5 (of 6.5) Mio. € // RIA

develop and **validate** containment **concepts** intended for the **bulk shipping** of liquid hydrogen suitable for later scale-up

HSD: HORIZON-JTI-CLEANH2-2022-02-11

Development and demonstration of mobile and stationary compressed hydrogen refuelling solutions for application in inland shipping and short-distance maritime operations

TRL 3 → 6 // 7 (of 7) Mio. € // IA

Improved understanding of the **health and safety requirements** for hydrogen bunkering; Identification of **regulatory challenges** and barriers; Guidelines and/or draft standards for **hydrogen bunkering** components and systems



# Clean Hydrogen Partnership - Call for proposals 2022 (iii)

TRA: HORIZON-JTI-CLEANH2-2022-03-01

Development and optimisation of reliable and versatile PEMFC stacks for high power range applications

TRL 3 → 5 // 3.5 (of 7) Mio. € // RIA

Uptake of the **developed solutions** by Fuel Cell system developers for their further implementation in trucks, ships, aircrafts or trains (2030); increase efficiency; lower cost

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H&P: HORIZON-JTI-CLEANH2-2022-04-01

Design and industrial deployment of innovative manufacturing processes for fuel cells and fuel cell components

MRL 4 → 7 // MAX 7 (of 7) Mio. € // IA // JU partner mand.

Increased fuel cell systems and component **manufacturing** capacity of European industry establishment of a European supply chain of specialised **solid oxide cells (SOC) manufacturing** equipment; Improved sustainability and cost reduction

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CC: HORIZON-JTI-CLEANH2-2022-05-01

Public understanding of hydrogen and fuel cell technologies

TRL n.a. // 1 (of 1) Mio. € // **CSA**

Understanding **public perceptions** and reactions; involvement of citizens in the implementation of solutions; pathways to influence **public opinion** by analysis of the current depiction of FCH technologies

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## Clean Hydrogen Partnership - Call for proposals 2022 (iii)

CC: HORIZON-JTI-CLEANH2-2022-05-03

Safe hydrogen injection management at network-wide level: towards European gas sector transition

TRL 3 → 6 // 3 (of 3) Mio. € // RIA

methods, tools and **technologies** for **multi-gas network management** and quality tracking, including **simulation**, prediction and safe management of transients; Best practice guidelines for handling the safety of hydrogen in the natural gas infrastructure; identify best available technologies

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HV: HORIZON-JTI-CLEANH2-2022-06-01

Hydrogen Valleys (large-scale)

TRL 6 → 8 // MAX 25 (of 25) Mio. € // IA // JU partner mand.

Showcase ability of H<sub>2</sub> to **decarbonise** different sectors in EU through this renewable hydrogen flagship project; **Demonstrate** how H<sub>2</sub> enables sector coupling and allows large integration of renewable energy on the selected territory; Include clear plans for **transport, storage** and **distribution of hydrogen**; Production of **at least 5,000 tonnes** of renewable H<sub>2</sub> per year

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HV: HORIZON-JTI-CLEANH2-2022-06-02

Hydrogen Valleys (small-scale)

TRL 6 → 8 // MAX 8 (of 8) Mio. € // IA // JU partner mand.

Production of **at least 500 tonnes** of renewable H<sub>2</sub> per year



## Unit:

# Information & Communication Technologies | Engineering & Natural Sciences (STEM)



Dr. Daniel Kießling  
Scientific Officer  
Nuremberg Office  
[kiessling@bayfor.org](mailto:kiessling@bayfor.org)

2000 – 2006 *Study Molecular Science FAU (Ms. Sc.)*

“Fluidic Alignment of Nanotube Structures for Nanoelectronic Devices and Application”

2006 – 2011 *PhD at LS Physikalische-Chemie (Prof. Guldi)*

„Carbon structured model systems for photovoltaic applications“

2011 – today *Scientific Officer BayFOR*

**Focus Areas:** Clean Hydrogen; Advanced Materials;  
Green Vehicles; Energy Efficient Buildings



## 1. EU-funds

## 2. Clean Hydrogen

## 3. Clean Aviation



## Clean Aviation Partnership (Joint Undertaking) - Background

The Clean Aviation JU is the European Union's **leading research and innovation programme** for transforming aviation towards a sustainable and climate neutral future.

It is a **PPP between the European Union** (Commission) and the **European aviation sector** (27 founding members and 12 associated members)

Funded topics are based on the **Clean Aviation Strategic Research and Innovation Agenda (SRIA)** 2021-2027.

It defines **two clear horizons** towards **climate neutrality**:

- **2030:** demonstrating and introducing **low-emissions aircraft concepts** based on Clean Aviation research results -> accelerated use of **sustainable fuels** and **optimized 'green' operations**, to entry into service 2030 – 2035
- **2050: climate-neutral aviation** by exploiting matured future technologies and full deployment of **sustainable aviation fuels** and **alternative energy carriers**



Strategic Research and Innovation Agenda

Version December 2021



Co-funded by  
the European Union



## Clean Aviation Partnership (Joint Undertaking) – Strategy

The **Clean Aviation programme** is built on **three key thrusts**, with **targeted R&I** and **demonstration efforts** for **energy efficiency** and **emissions reduction**: develop technology and enablers, leverage essential knowledge and capabilities, de-risk identified technologies and solutions.

- Hybrid electric regional aircraft (HER)
- Ultra-efficient short/short-medium range aircraft (SMR)
- **Disruptive technologies to enable hydrogen-powered aircraft (H<sub>2</sub>)**

**Implementation** of the programme divided in **two phases**:

- **Phase 1 (2022 – 2025):** identify **high-potential disruptive aircraft concepts**, down-selection of the **most promising technology options** and integrated solutions, **maturity of technologies** and key-enablers
- **Phase 2 (2026 – 2031):** focus on **most promising aircraft architectures** and **integration** of the selected best candidate technologies focusing on **breakthrough demonstrators** → large-scale integrated aircraft component/system tests, large-scale flying demonstrator platforms





# Clean Aviation Phase 1 - Call for proposals WP 2022/23

~~Call#1: 735 Mio €, launch 23.03.2022, deadline 23.06.2022 ☹~~

**Call#2: 72 Mio €, launch Q1-2023, deadline to be announced (only DRAFT)**

Funding programme      Horizon Europe [Clean Aviation Joint Undertaking](#)

## Thrust H<sub>2</sub> rationale & priorities phase 1:

- Support the **development of key enabling technologies** (fuel cells, stacks, tanks, fuel distribution, propulsion) **in coordination with Clean Hydrogen Joint Undertaking** and critical to a **hydrogen-based propulsion system**
- **Performance and reliability consistent** with the requirements expected by the HER and SMR ambitions, for subsequent uptake and integration at the level of these aircraft
- H<sub>2</sub> thrust supporting **Early Ground Demo** (in Phase 1) and **flight tests** (in Phase 2), which are major contributors to the H<sub>2</sub> climate assessment



## WP 2022 - 23 topics and funding allocation

Funding Allocation	Call#1	Call#2	Total
Direct Combustion of Hydrogen in Aero-engines	115	0	115
Multi-Megawatt Fuel Cell Propulsion System .....	50	0	50
Large-Scale Lightweight Liquid Hydrogen Integral Storage...	10	0	10
Near Term Disruptive Technologies....	7	0	7
HORIZON-JU-CLEAN-AVIATION-2023-02-HPA-01	<b>0</b>	<b>10</b>	<b>10</b>
Liquid Hydrogen Fuel Distribution Technologies			
HORIZON-JU-CLEAN-AVIATION-2023-02-HPA-02	<b>0</b>	<b>15</b>	<b>15</b>
Longer Term Disruptive Technologies for Hydrogen-Powered Aircraft			
<b>Hydrogen Powered Aircraft (H<sub>2</sub>)</b>	<b>Σ 182</b>	<b>Σ 25</b>	<b>Σ 207</b>



# Clean Aviation Hydrogen Powered Aircraft Call#2

HORIZON-JU-CLEAN-AVIATION-2023-02-HPA-01

TRL6 // 10 Mio. €, 1 project // IA

Liquid Hydrogen Fuel Distribution Technologies  
only draft

**Design and development** of liquid hydrogen fuel distribution system components for Fuel Cell and Hydrogen Direct Burn **Propulsion Systems** (modelling & simulation, up to ground demonstration of full functional system at TRL6 by end of Phase 1)

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HORIZON-JU-CLEAN-AVIATION-2023-02-HPA-02

TRL5 // 15 Mio. €, 1 project // IA

Long Term Disruptive Technologies for Hydrogen-Powered Aircraft  
only draft

Develop and test a generic **cryogenic** (~500kW) **powertrain** consisting of a superconducting distribution system, a superconducting motor, cryogenically cooled power electronics, a superconducting electrical protection and a cryogenic system up to TRL4, upscaling to MW level ground test @TRL5 by end of Phase 1

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## Unit:

# Information & Communication Technologies | Engineering & Natural Sciences (STEM)



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1998 – 2002 *Study Industrial Engineering, Karlsruhe (diploma)*

2002 – 2014 *Research Associate University Karlsruhe, FZI Research Center for Information Technology, Karlsruhe Institute for Technology*

Since 2015 *Scientific Officer BayFOR*

**Main topics:** Artificial Intelligence, Robotics and Autonomous Systems, ICT, Aviation/Aerospace



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- 2007 – heute    *BayFOR – Head of Unit „STEM“*
- 2004 – 2005    *Research at DESY/HASYLab, ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin)*
- 2001 – 2006    *PhD thesis at TU München/Physics at Prof. Petry „Charakterisierung von ternären Polymerfilmen mittels Rasterkraftmikroskopie, Neutronen- und Synchrotronstreuung“*
- 1999 – 2000    *Diploma thesis at Physical Chemistry: Charakterisierung dünner Polymerfilme mittels Rasterkraftmikroskopie*
- 1995 – 1996    *Studies at École supérieure de chimie physique électronique de Lyon, CNRS (Laboratoire de Chimie de Surface)*
- 1992 – 2000    *Study Chemistry at the university of Bayreuth*



# Σας ευχαριστώ για την προσοχή σας Danke für Ihre Aufmerksamkeit

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**@ Bavarian Research and innovation agency ([BayFIA.de](http://BayFIA.de))**

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