CDTI-NEDO online Joint Workshop on Hydrogen Technology
- Green Hydrogen Production & Mobility -

Shinefleet: Use of Hydrogen in Heavy Duty Vehicle fleets

Miguel Angel Vega Pacho
Business Development Manager
Técnicas Reunidas, S.A.

TECNICAS REUNIDAS

MINISTERIO DE CIENCIA E INNOVACIÓN
CDTI
@CDTIoficial

NEDO

AeH2 ASOCIACIÓN ESPAÑOLA DEL HIDRÓGENO

Técnicas Reunidas at a glance

Técnicas Reunidas is a global leader in the design and management of the construction of complex industrial plants throughout the world.

60 years of continued growth	**8,000** professionals of over **70** nationalities	**60** countries where we have operated
+$50 billion in projects in the last 10 years	More than **1,000 industrial plants**	Safety Performance / **Zero** Incident Target
$4 billion per year in purchasing and subcontracting	**92.2/100** Project quality index **(PQI)**	**~30 B$** value of projects in execution

2021- Q1

Backlog, M€	8,900
Sales, M€	3,500
Employees	8,000

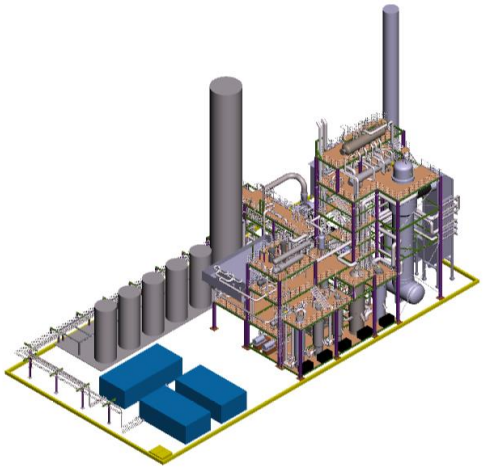
Técnicas Reunidas at a glance

Main Business lines

(Petro)chemical — Oil&gas

Energy — Water

Decarbonization & Energy Transition



Main Markets

Spain, Europe, Saudi Arabia, UAE, Kuwait, Bahrein,Oman, Algeria,Singapur, Indonesia, Malaysia, Turkey, Russia, Poland, Finland, UK, Azerbaijan, Peru, Chile, Mexico, Canada, US, China, Australia

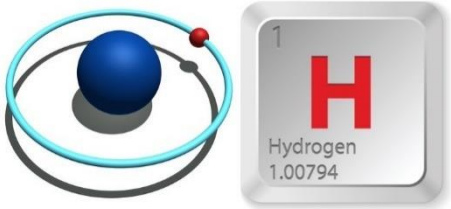
Strong references in H2 Units

37 Hydrocracking Units

23 Catalytic Reforming Units

92 Hydro-treatment Units

25 Hydrogen Production Units



Técnicas Reunidas at a glance - Services

Full Range of Services

Conceptual analysis of opportunities, pre-feasibility studies	OBE- Open Book Estimate	Procurement
Basic Engineering	EPC	Collaboration in financial structuration
FEED-Front End Engineering and Design	PMC – Project Management Consultant	Quality, Environment and Safety Management
Detail Engineering	Construction, Assembly and Commissioning	Research & Development

Técnicas Reunidas at a glance - Services

TRL 9
TRL 8
TRL 7
TRL 6
TRL 5
TRL 4
TRL 3
TRL 2
TRL 1

Técnicas Reunidas is a technological partner for all the stages of technology or product development, from conceptual design to industrial deployment.

R&D

Low-Medium TRL

- R&D Center of Técnicas Reunidas
- Lab scale and Pilot Plants
- Collaboration with Technology Centers and Universities

Innovation

Medium-High TRL

- Scaling-up, industrialization, product development
- Pilot plants, “demo” plants

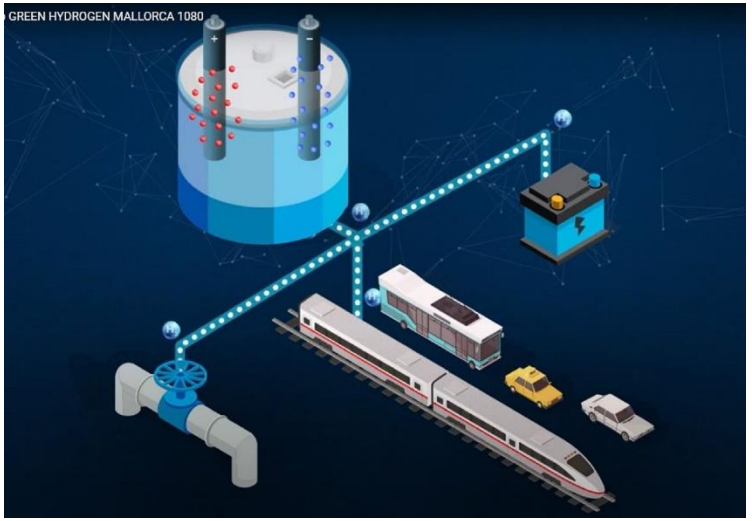
Industrial Projects

High TRL

- Technology Integration (proprietary or from other technology providers)
- EPC projects
- Turn-key projects

Técnicas Reunidas at a glance - Services

SOME REFERENCES IN ENERGY TRANSITION PROJECTS AND HYDROGEN



- ✓ **Power To Green Hydrogen Mallorca (2020)**
  - Engineering Services, “Hydrogen Ecosystem”
- ✓ **Advanced Methanol Amsterdam (2020)**
  - Biomass Gasification to produce Green Methanol
- ✓ **SISCATCOM (2011-2014 … 2020)**
  - Partially funded by CDTI
  - Compact catalytic System, producing Hydrogen from Bioethanol, suitable to feed a Fuel Cell
- ✓ **Circular Economy: Recycling of wind turbine blades (2020)**
- ✓ **Shinefleet (2020)**
  - Innovative solutions for Intelligent and Sustainable Mobility based on Hydrogen, for Heavy Duty Fleets

Shinefleet
Use of Hydrogen in Heavy Duty Vehicle fleets

Shinefleet

One example of Spanish industrial investigation across the H2 value chain 2020-2023

7 companies, 6 R&D centers
Leaded by **Técnicas Reunidas**

With partial funding of:

MINISTERIO DE CIENCIA E INNOVACIÓN

CDTI

Avia Ingeniería y Diseño, S.L. · CARBO TAINER · cikautxo GROUP · FM LOGISTIC · FRACTALIA · idneo · TECNICAS REUNIDAS

tecnalia Inspiring Business · Universidad Complutense Madrid · ITQ Instituto de Tecnología Química · UAM Universidad Autónoma de Madrid · Centro Nacional de Hidrógeno

Shinefleet
Use of Hydrogen in Heavy Duty Vehicle fleets

FRACTALIA

Overall Control System for the management of the heavy vehicles fleet linked to the H_2 production equipment
- Real time optimization of CO_2 footprint, operative costs, maintenance and production of H_2

H_2 Production and Supply

TECNICAS REUNIDAS

- On-site production
- Multifuel: bioethanol, biogas, NG,
- CO_2 capture

Avia Ingeniería y Diseño, S.L.

- Digital twin and and E-Horizon smart control vehicle
- Hybrid energy management system

cikautxo

- Advanced thermal management system
- Innovative O_2 and H_2O systems
- New concepts for H_2 on-board storage

CARBO TAINER

- Intelligent H_2 on-board storage

Autonomous and interconnected fleet

FM LOGISTIC

- Driverless maneuvers
- Driver-vehicle cooperative assitance

idneo

5G

- V2X 5G communications

MINISTERIO DE CIENCIA E INNOVACIÓN
CDTI

Research Centres

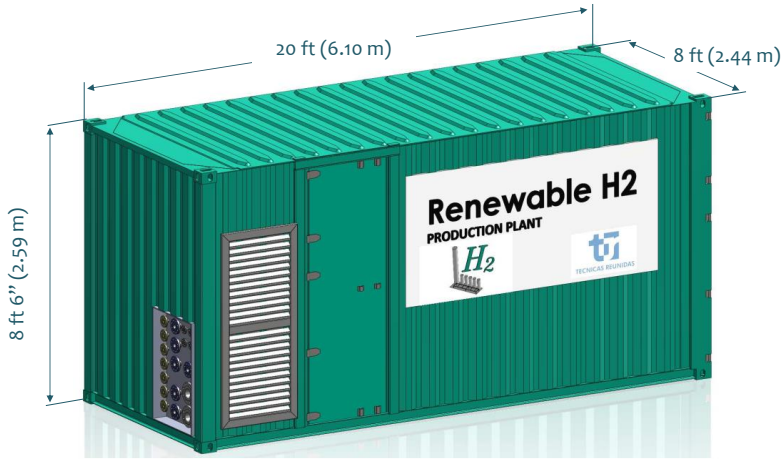
tecnalia Inspiring Business
UNIVERSIDAD COMPLUTENSE
INSTITUTO DE TECNOLOGÍA QUÍMICA
UAM Universidad Autónoma de Madrid
Centro Nacional del Hidrógeno
eurecat Centre Tecnològic de Catalunya

Shinefleet
Use of Hydrogen in Heavy Duty Vehicle fleets

SPECIFIC RESEARCH LINES OF TÉCNICAS REUNIDAS

TECNICAS REUNIDAS

- ✓ R&D on **Multifuel Hydrogen Generation Unit**:
  - **Hydrogen Production** from several renewable sources:
    - Biofuels reforming (biogas, biomethane, bioethanol) and catalyst development
    - Study of Hybridation of different sources (water electrolysis)
  - **Hydrogen Purification:**
    - PSAs
    - Membranes (metallic & polymeric)
  - **CO_2 Capture**:
    - PSAs
    - Membranes (polymeric)
    - Ionic Liquids



- ✓ Overall **control of the system as a whole** (fleet and Hydrogen generator)

Shinefleet
Use of Hydrogen in Heavy Duty Vehicle fleets

MAIN CHALLENGES (1 / 2)

✓ Compliance with Project KPIs and Objectives:

- **Decarbonization KPI:** reduction of emissions of CO_{2eq}
  - Goal: >50% reduction, compared to actual solutions, LCA basis

- **Health KPI:** reduction of emissions of NO_x, SO_x, CO & NMVOCs(*)
  - Goal: >80% reduction, compared to actual solutions, LCA basis

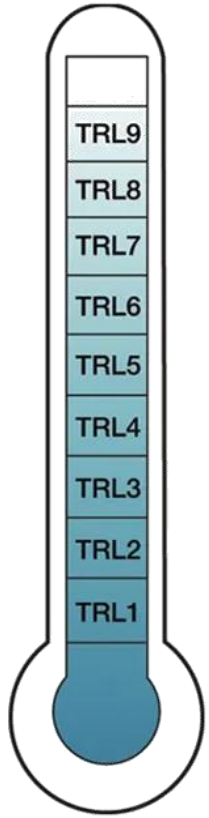
- **Intelligence KPI:** Monitoring, analytics, control of the system as a whole
  - Goal: >72% of intelligence actuations are accomplished

- Additional KPI: **cost benchmark & cost reduction**
  - Goal: competitive solution when compared to actual solutions, LCA basis

(*) NMVOCs: Non-Methane Volatile Organic Compounds

Shinefleet
Use of Hydrogen in Heavy Duty Vehicle fleets

MAIN CHALLENGES (2 / 2)



- ✓ Build a **TRL 5 Functional Prototype: autonomous FC Heavy Duty truck**
  - Tested at Logistic company facilities
  - Automatic and assisted manoeuvres
- ✓ Build a **TRL 4/5 Systems: Hydrogen Generation and Hydrogen Purification**
  - Tested at Técnicas Reunidas facilities, R&D center (Madrid)
  - Production of H2 from biofuels and natural gas
  - Purification of syngas, suitable for mobility standards
- ✓ Study of **Integration** of the complete Hydrogen Value Chain and intelligent control strategies
  - Development of software for system monitoring and control

Ideas for a Japan – Spain collaboration

- ✓ **<u>Collaborative Projects in Heavy Duty Vehicles Fleets fuelled with Hydrogen</u>**
  - Hydrogen generation from different sources, hybridation and smart control
  - Control of the system as a whole

- ✓ Green Hydrogen Projects can be very competitive in Spain – and TR has strong references

- ✓ Strategic geolocation of Spain: bridge to the balance of Europe, South-America and North Africa