

A background image featuring a complex molecular structure composed of numerous translucent blue and green spheres connected by thin, light-colored lines. The spheres vary in size and are arranged in a network-like pattern, set against a gradient background that transitions from a deep green on the left to a bright cyan on the right.

***HENSOLDT Sustainable Energy Solutions  
Moroccan Green H2 Cluster***

# HENSOLDT Capabilities

Our core competence is to detect threats and protect what matters most

## SPACE

- Optical communication in space
- Planet and space observation
- Protection in space
- Space consulting

## AIR

- Air traffic control
- Identification friend-or-foe
- Platform protection
- Air defence
- ISTAR
- Situational awareness
- Air mission management
- Electronic support and attack

## LAND

- Observation and targeting
- Situational awareness
- Reconnaissance and surveillance
- Platform and force protection
- Electronic support and attack
- Off-grid power supply

## SEA

- Coastal surveillance
- Platform protection
- Situational awareness
- ISTAR
- Navigation
- Electronic support and attack

## SECURITY

- Border protection
- Infrastructure protection
- Force protection
- Counter drone

## CYBER

- Controlling the information space
- Embedded secure IT
- Tactical cyber security
- Cryptology and secure communication
- AI-based OSINT analytics

# HENSOLDT in France

## Decision-aid & embedded systems

Mission management systems  
Drone countermeasures  
Mission computers  
Rugged monitors

## Lifetime extension

In-service support  
Maintenance  
Obsolescence management  
Cloning & repair

## Cybersecurity

IFF & cryptography  
Tactical link to data  
Secure networks

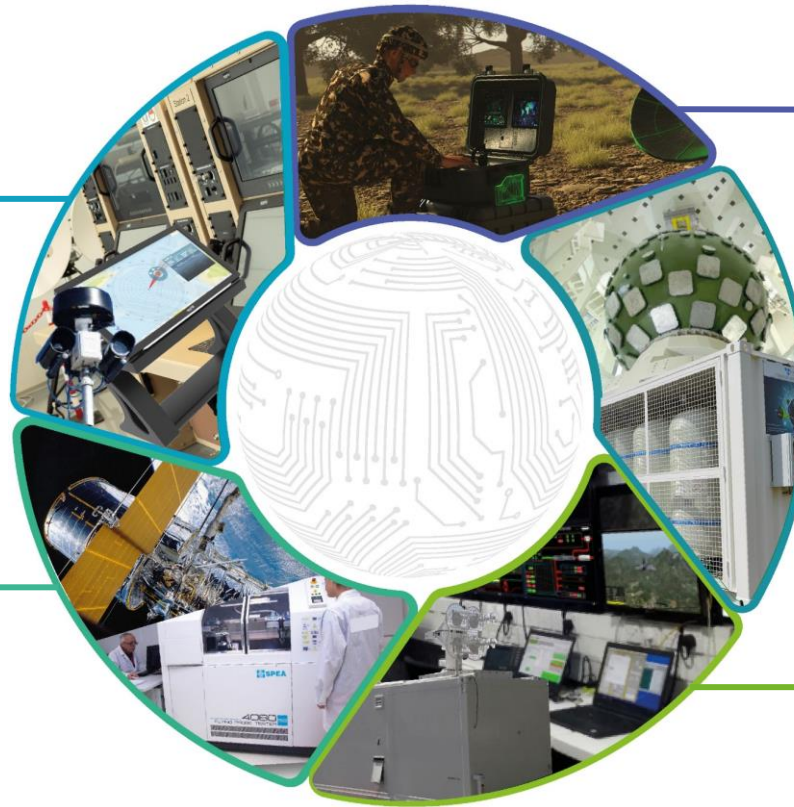
## Energy

### Hydrogen

Power conversion  
Security CC  
Demagnetisation

## Test & Simulation

Integration of complex systems  
Simulation & training  
Test benches  
In-flight testing



Control & command,  
industrial automation  
and engine control



Production and  
maintenance  
tools



Space consultancy  
and training

# Hydrogen context

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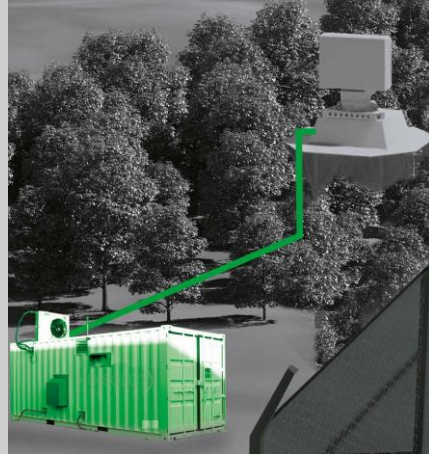
- Global warming situation and market financial pressure (ESG label)
    - Need to find alternative to decarbonize traditional energy sources.
  - Between other solutions, “green” hydrogen as a potential solution known for a long time
  - Recent significant technological improvement in production efficiency
    - Credible energy source with further room for improvement
  - **Main assets:**
    - **Powerful** → 3 times more energy per kg as gasoline
    - **Complementary to other low carbon energy sources** → Can capitalize on excessive possible volatile renewable energies, complement to batteries (long-term storage capacity)
    - **Versatile** → Direct combustion in engines or transformation to electricity through fuel cell
- Strong market development expected in the next decade and associated volume effect**
- Example: European Commission expect production volume to increase from 6GW electrolyzer capacity till 2024 to 40GW in 2040.

Nota: 1MW represents 450kg H2 per day

# Sustainable Energy Solutions – Civil Market

1

## LOCAL ENERGY PRODUCTION



**Autonomous and turnkey installation with both:**

- H2 production, storage
- **Generation of H2 based electricity**

2

## H2 LOGISTIC & DISTRIBUTION



**High pressure storage solutions for either large volume transport, or local distribution**

# 1 – LOCAL ENERGY PRODUCTION based on H2

## ■ Rationale / Motivations:

- Willingness to limit carbon footprint
- Ensure stable, reliable and independent energy source

## ■ Application fields:

- Eco-neighborhood / Building / Facility supply with independent green energy source
- Energy supply for remote, off-grid installation
- Supply of energy critical applications
- Electric network balancing
- Cold ironing : supply electrical power to ship in harbor

## ■ Challenges:

- Deployability
- Safe for use
- Maintainability
- Is it tailored for my application?

## ■ Application examples:



### ■ Dialysis center energy supply in Guinea

- Electrical supply stabilization for critical medical application (dialysis)
- Photovoltaic production (400m<sup>2</sup> 80 kWp)
- Ecofriendly and stable electrical production (15 kW) for off grid area (medical center)



### ■ Barge energy supply Sete Harbor (Study)

- Multiservice energy barge able to supply 1,5 MW for ships (small cargo, ferries, car carrier,...) at the dock (cold ironing)
- Reduction of local GHG emission (avoid gasoil usage)



### ■ Eco District in la Rochelle

- Photovoltaic production (1500m<sup>2</sup> 300 kWp) for the smart-grid self consumption
- Energy supply for a high school, public light and electric vehicle charging station
- Excess of electricity to produce up to 10kg H<sub>2</sub> for related light mobility (bike, last mile delivery...)

Nota: surface basketball field : approx.400m<sup>2</sup> / football field: approx.7000m<sup>2</sup>

# 1 – LOCAL ENERGY PRODUCTION - HENSOLDT Solution: H2-Grid

## ■ Description of the Solution:

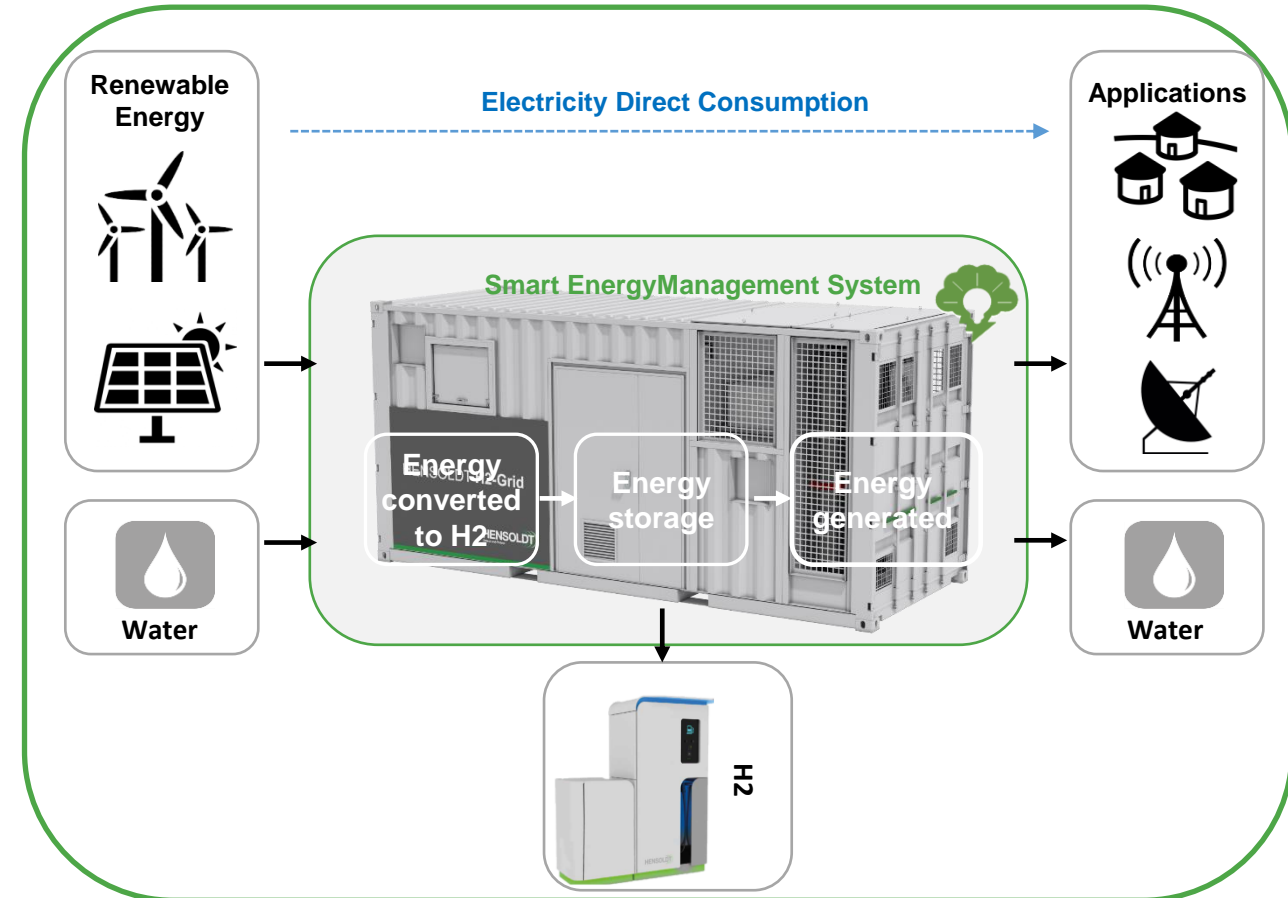
- Interconnection to renewable energy sources (solar, wind,...)
- Hydrogen generation (Electrolyzer)
- Energy generation (Fuel cell)
- Storage system: batteries and Type IV hydrogen tanks
- Water recycling
- Smart Energy Management System (Predictive algorithm)
- Output for H2 vehicle dispenser

## ■ Key Characteristics:

- Range from a few kW to 60kW (20ft container) and then up to 250 kW (with additional container)
- Storage capacity up to 600 kWh (32 kg H2)
- Operating temperature -10°C + 40°C
- Water consumption: 1000L over 1 year (1 container version)

## ■ Customer Added Value:

- Turnkey integrated product (all-in-one Power-to-Power stages)
- Scalable solution (pre-study to tailor solution)
- Smart Energy management system
- Easily deployable
- Fulfill safety standard
- Low maintenance effort / Remote monitoring
- No pollution / silent



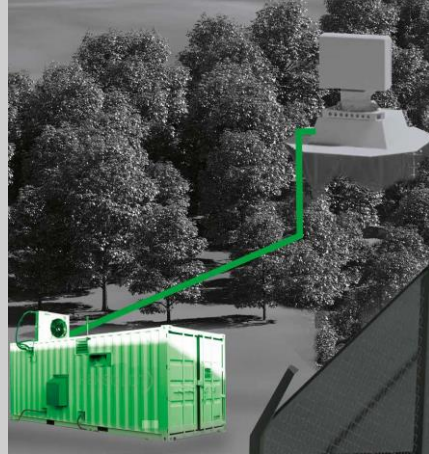
## ■ H2-Grid Solution:

- Maturity: First delivery 2020

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## H2 LOGISTIC & DISTRIBUTION



**High pressure storage solutions for either large volume transport, or local distribution**

## 2 - H2 LOGISTIC and DISTRIBUTION

### ▪ Rationale / Motivations:

- interconnect H2 production plant to intermediate operator or final user
- long-term storage
- easily transportable

### ▪ Application cases:

- H2 multimodal transport (logistic)
- Supply of isolated sites
- Supply of H2-powered boats
- Supply of barges port
- Supply of H2 dispensers



### ▪ Challenges:

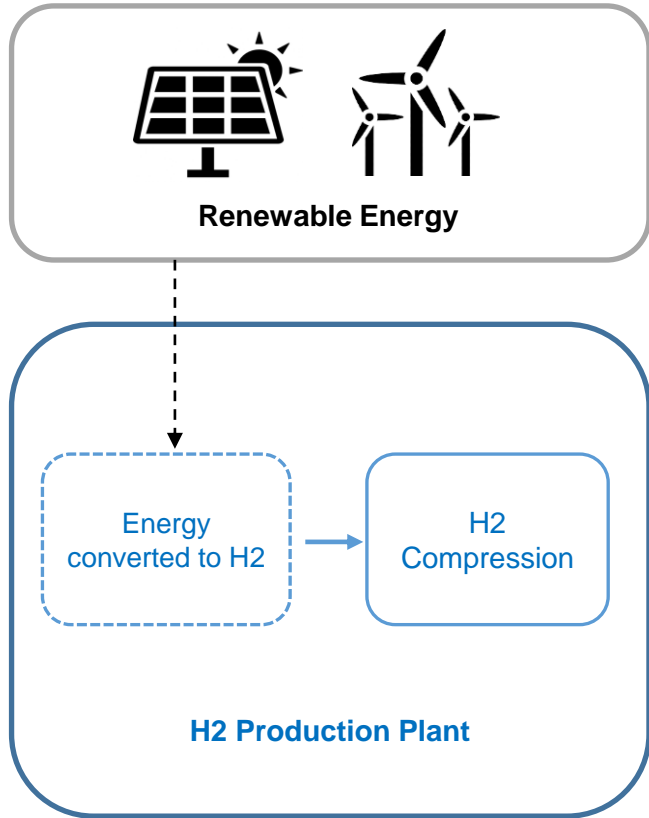
- Compliancy to transport standards
- Safe for use / Ease of operation
- Maintenance
- Tradeoff volume/weight vs quantity H2

### ▪ Application examples:

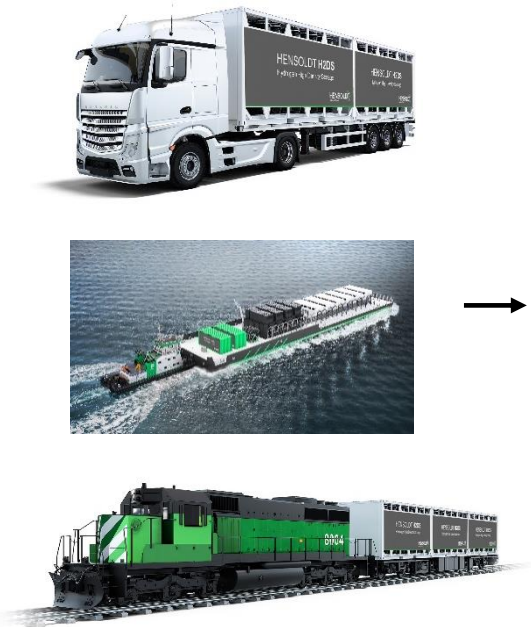
- **Hydrogen logistic in an eco-district in La Rochelle**
  - Hydrogen logistic between production plant and usages
  - Local Transportation of 60 kg of H2 to dispenser
  - Hydrogen vehicle refueling solution directly connected to the logistic solution.
- **Green H2 manufacturing plant (coupled to wind turbine field) , study, in North Germany to supply the region local needs by road or boat transportation.**
  - Need to transport produced H2: 340 tons per year.

# 2 -H2 LOGISTIC & DISTRIBUTION

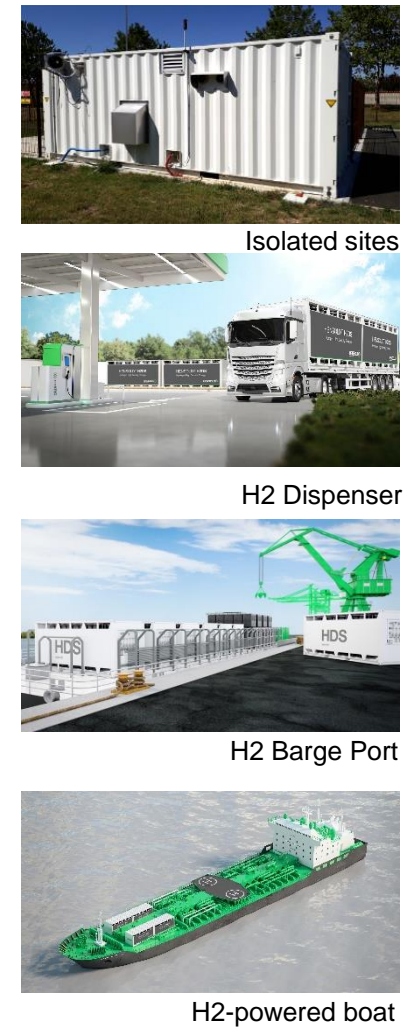
## FROM PRODUCTION SITES TO USERS



### Multimodal Transport



### H2 Supply



## 2 - H2 LOGISTIC and DISTRIBUTION - HENSOLDT Solution : H2DS

### ■ Description of the solution:

- High Density Storage container (MEGC)
- Multiple element type IV lightweight gas containers
- Pressure and temperature monitoring
- Gas detection provided (fire and ambient H2)
- Operation with 1 main outlet or 5 independent outlets

### ■ Key Characteristics:

- 450 kg of compressed H2 (7,2 MWh with Fuel Cell 50% eff. )
- Maximum filling pressure 500 bar at 15°C
- Total weight < 17 tons
- ISO668 dimensions (6058\*2438\*2896mm)
- Homologation Road (ADR), Rail (RID), Ship (IMDG), Boat (ADN) Compatible with IGF ships
- H2 loading time: 3 to 8 hours
- 20 years lifetime / 5000 cycles

### ■ Customer added Value:

- Multimodal transport compliant
- Optimised volumetric density (thanks to specific internal know-how)
- Light maintenance, easy operation
- Possibility direct plug to dispenser



### ■ HDS Solution

- Maturity:
  - V1 deployed 2022
  - V2 increased capacity 2024

## 2 - H2 LOGISTIC and DISTRIBUTION - HENSOLDT Solution : BUNDL'HY

### ■ Description of the solution:

- Multiple Element type IV lightweight gas container
- End plug + Valve 500 bars
- Outlet line : from 1 to 5

### ■ Key Characteristics:

- From 19 to 57 kg of hydrogen storage (modular 3 to 6 tanks)
- Dimensions:
  - 2,4\*1,5\*0,7m (3 tanks 200L configuration)
  - 3,3\*1,8\*2,7m (6 tanks 300L configuration)
- PED and TPED/ADR certified
- 20 years lifetime / 5000 Cycles

### ■ Customer added Value:

- Scalable local storage
- Transport compliant (on road and local with forklift)
- Possibility direct plug to dispenser



### ■ Bundl'hy Solution

- Maturity:                      deployed                      2021