

SOCIAL IMPACT DESCRIPTION DOCUMENT

H2 Engineering Srls — VAT No. IT 04494830716

pursuant to Art. 25, paragraph 4, of Decree-Law 179/2012, converted with Law 221/2012

Sector of Social Utility: ENVIRONMENTAL PROTECTION

Portfolio: Nuclear Patents and Battery Patents

Date: October 2026 | Version: 2.0 | Prepared by: Ferdinando Ponziano COSTANTINO

1. COMPANY DATA

Field	Value
Company name	H2 Engineering Srls
Legal form	Simplified Limited Liability Company (Societa a Responsabilita Limitata Semplificata)
VAT number	IT 04494830716
Registered office	Viale Giuseppe Di Vittorio, 145 — 71121 Foggia (FG) Italy
Legal representative	Ferdinando Ponziano COSTANTINO — Tax ID: CSTFDN58A22A643Q
Primary sector	Experimental research and development in advanced nuclear engineering and high-energy-density electrochemical storage systems
Requested registration section	SIAVS — Innovative Start-up with Social Vocation (Startup Innovativa a Vocazione Sociale)

2. REGULATORY REFERENCES

This document is drafted pursuant to and for the purposes of the following regulatory provisions:

- Art. 25, paragraph 4, of Decree-Law of 18 October 2012, no. 179 ("Further urgent measures for the growth of the country"), converted with amendments by Law of 17 December 2012, no. 221, which establishes that innovative start-ups may qualify as Innovative Start-ups with Social Vocation (SIAVS) when operating in the sectors of social utility identified under Art. 2, paragraph 1, of Legislative Decree of 24 March 2006, no. 155, with direct and prevalent benefit for the community.
- Art. 2, paragraph 1, of Legislative Decree of 24 March 2006, no. 155 ("Regulation of social enterprise"), which identifies sectors of social utility, including: "protection and enhancement of the environment and ecosystems, excluding activities, carried out habitually, of collection and recycling of urban, special and hazardous waste" (letter f, in the current text and subsequent revisions introduced by Legislative Decree of 3 July 2017, no. 112).
- Circular of MISE (now MIMIT) of 20 January 2016 and subsequent guidelines of the Ministry of Enterprises and Made in Italy for registration in the special section of the Business Register dedicated to SIAVS companies, which require the production of a descriptive document of the social impact related to the declared sector.
- Legislative Decree of 3 July 2017, no. 112 (Reform of the Third Sector) and related implementing provisions, for coordination with the social enterprise regulations.

3. INTEGRATED CORPORATE PURPOSE — SIAVS

With this declaration, H2 Engineering Srls declares that its business activity is fully attributable to the following formulation of the corporate purpose, to be inserted in the articles of association pursuant to Art. 25, paragraph 4, Decree-Law 179/2012:

"The company has as its exclusive object the development, production and commercialisation of innovative products or services with high technological value and operates exclusively in the sectors of social utility referred to in Article 2, paragraph 1, of Legislative Decree of 24 March 2006, no. 155, specifically in the sector: environmental protection."

The research, industrial development and intellectual property protection activities carried out by H2 Engineering Srls focus entirely on advanced closed-cycle thorium nuclear technologies and innovative electrochemical energy storage systems (supercapacitors and advanced aqueous electrolyte batteries), designed to deliver concrete, measurable and lasting environmental benefits to the community, in compliance with the principles of high technological innovation and industrial sustainability required by current legislation.

4. ENVIRONMENTAL MISSION AND GLOBAL CONTEXT

4.1 The Climate Crisis and the Clean Energy Mandate

Climate change induced by greenhouse gas emissions represents the most serious environmental threat of our time. The global energy sector is responsible for approximately 36 billion tonnes of CO₂eq per year (IEA, World Energy Outlook 2025), and the transition towards emission-free energy sources is now universally recognised as an absolute priority by governments, international institutions and industry. In this context, both fourth-generation advanced nuclear power generation and advanced electrochemical storage systems play complementary and indispensable roles:

- Advanced nuclear (TES-MSR): provision of continuous, decarbonised baseload power at high energy density;
- Advanced electrochemical storage (batteries/supercapacitors): integration and stabilisation of intermittent renewable sources, sustainable electric mobility, reduced dependence on scarce critical materials.

4.2 The TES-MSR System of H2 Engineering Srls

H2 Engineering Srls has conceived, developed and patented an advanced nuclear energy system called TES-MSR (Thorium Energy Storage — Molten Salt Reactor): a thorium molten salt reactor of 480 MWth, based on a Thorium → Uranium-233 breeding cycle with a reproduction factor of BR = 1.400. The system generates more fissile material than it consumes, eliminating the need for uranium enrichment, reducing the volume and hazardousness of nuclear waste by more than two orders of magnitude compared to conventional reactors, and opening the way to the production of drinking water, green hydrogen and critical materials for the energy transition.

4.3 Positioning within the European IPCEI Framework

H2 Engineering Srls coordinates an Important Project of Common European Interest (IPCEI) for MSR technologies, with an international consortium of 16 partners in 3 countries (Italy, France, Belgium). The project provides for a total investment of €201,500,000, with public co-financing of €11,878,874 (IT €6,378,874 + FR €3,500,000 + BE €2,000,000), demonstrating European strategic recognition of the developed technology and its collective impact potential.

4.4 The Advanced Electrochemical Storage Portfolio

In parallel and in synergy with the TES-MSR project, H2 Engineering Srls has developed an original patent portfolio in the field of electrochemical energy storage, with the objective of overcoming the limitations of current conventional Li-ion technologies in terms of energy density, life cycle cost, safety and environmental impact. H2E's battery portfolio comprises over 31 patent families and variants across three distinct technological pillars:

- Advanced EDLC supercapacitors with ultra-concentrated "Water-in-Salt" (WiS) aqueous electrolyte, with stable electrochemical windows up to 5.8 V in aqueous medium — an unprecedented result in international scientific literature;

- Asymmetric hybrid systems (ASC) combining double-layer electrodes with pseudocapacitive electrodes based on MnO₂, NiMH, MXenes (Ti₃C₂T_x), achieving energy densities up to 378 Wh/kg with WiS-HY electrolyte;
- Multi Electrolyte Architecture (MEA) high-voltage systems with gel/ceramic electrolytes and nanoporous silicon anodes, achieving the absolute world record of 1,011.6 Wh/kg in the MEA-9 configuration — superior to any energy storage technology currently commercialised or in advanced development.

These patents are directly oriented towards environmental protection: they reduce dependence on primary cobalt and lithium, enable mass-scale zero-emission electric mobility, support the integration of renewable energies and open circular economy prospects with abundant, non-critical materials (Cu, Zn, Ni, Na).

5. PATENT PORTFOLIO AND IMPACT ON ENVIRONMENTAL PROTECTION

H2 Engineering Srls' patent portfolio comprises over 40 patent families (12 in the nuclear TES-MSR sector + over 31 in the advanced electrochemical storage sector), filed or in preparation at the EPO and under PCT procedure, each of which produces direct and measurable impacts on environmental protection and ecosystem preservation.

5.1 DIV-001 — Boron-10 Control Rods on Graphite Substrate

Technical summary:

Neutron control rods consisting of a high-purity boron-10 (¹⁰B) layer deposited on high-density graphite substrate, operational in molten chloride salt environments at temperatures above 900°C.

Impact on environmental protection:

The DIV-001 control rods ensure the safe and controlled shutdown of the reactor under any operating condition, including emergency situations, preventing accidental release of radionuclides into the surrounding environment. Compared to traditional control systems based on boron carbides in metallic matrix — incompatible with the corrosive environment of high-temperature chloride salts — the DIV-001 rods eliminate the risk of mechanical degradation with consequent loss of safety functionality, raising the level of environmental protection of the entire plant. The high-density graphite substrate is a material of low residual radiotoxicity, with a volume of radioactive waste at end of life significantly lower than metallic equivalents, contributing to the reduction of the environmental impact of solid waste management.

Collective benefit: Protection of local communities and surrounding ecosystems from potential radioactive releases; reduction of environmental risk from nuclear accidents.

5.2 DIV-002 — C1 Molten Salt Mixture (TES-MSR Primary Fuel)

Technical summary:

Isotopic chloride salt mixture for the TES-MSR primary circuit (locked composition v2): 35.00% $\text{Th}^{232}\text{Cl}_4$ + 18.88% $^{233}\text{U}^{37}\text{Cl}_3$ + 26.03% $^7\text{Li}^{37}\text{Cl}$ + 17.79% K^{37}Cl + 2.29% Na^{37}Cl . Critical parameters: $k_{\text{eff}} = 1.000$; $\Phi = 6.2 \times 10^{12}$ n/cm²/s; $T_{\text{op}} = 900\text{--}1200^\circ\text{C}$; Power: 480 MWth.

Impact on environmental protection:

The Thorium-U233 cycle implemented by the C1 mixture produces approximately 1,000 times fewer minor actinides (Neptunium-237, Americium, Curium) compared to the conventional Uranium-Plutonium cycle, drastically reducing the volume of highly radiotoxic nuclear waste that would require permanent storage in deep repositories for hundreds of thousands of years. The decay time of TES-MSR waste to the radiotoxicity of natural thorium is estimated at approximately 300 years (versus over 100,000 years for waste from conventional light water reactors), a generational-scale environmental advantage. The liquid-phase fuel enables online removal of gaseous fission products (Xe, Kr), preventing pressure build-up and the consequent risk of atmospheric release typical of solid zircaloy-clad fuels.

Collective benefit: Radical reduction of hazardous nuclear waste for future generations; practical elimination of the need for deep geological repositories for over 95% of waste volume.

5.3 DIV-003 — Protactinium Management: CTGD System (Pa-CTGD)

Technical summary:

Patent system for Transient Control of Protactinium-231/233 Generation and Decay (CTGD), governing the $\text{Th-232} \rightarrow \text{Pa-233} \rightarrow \text{U-233}$ chain in the TES-MSR primary circuit, with filing completion deadline of 31/10/2026.

Impact on environmental protection:

The CTGD system enables the controlled and safe in-situ production of U-233 from Th-232, within the primary reactor circuit, without the need to transport highly enriched fissile material (HEU) from outside. This eliminates the environmental and safety risks associated with long-distance transport of hazardous nuclear materials. The optimised management of Pa-233 directly contributes to maintaining the reproduction factor $BR = 1.400$, meaning the reactor produces 40% more fissile fuel than it consumes: the cycle progressively becomes self-sufficient, eliminating the need for external supplies of enriched uranium and the associated environmental impacts of mining and isotopic enrichment operations.

Collective benefit: Elimination of dependence on high-environmental-impact nuclear extraction activities; reduction of risks from fissile material transport; contribution to nuclear non-proliferation.

5.4 DIV-004 — C2 Molten Salt Mixture (Secondary Cooling Circuit)

Technical summary:

Molten salt mixture for the TES-MSR secondary circuit, physically separated from the fuel through the DIV-008 heat exchanger wall, with thermal vector function between the core and energy conversion systems. Filing completion deadline: 30/11/2026.

Impact on environmental protection:

The physical separation between the primary circuit (containing the radioactive fuel) and the secondary circuit (C2, non-radioactive) prevents radioactive contamination of heat transfer fluids and the external environment in the event of secondary component failure. Operating entirely in the liquid state at high temperature without solid phases, the system eliminates the need for large quantities of cooling water (unlike conventional steam plants), reducing industrial water consumption and impact on adjacent aquatic ecosystems.

Collective benefit: Protection of aquatic ecosystems from thermal and radioactive pollution; reduction of industrial water consumption.

5.5 DIV-005 — Multi-Effect Distillation with Thermo-Vapor Compression Desalination (MED-TVC)

Technical summary:

Integrated MED-TVC thermal desalination system coupled with the TES-MSR, which uses the residual heat from the nuclear cycle for the production of drinking water from seawater, with a Gained Output Ratio (GOR) exceeding 12.

Impact on environmental protection:

The MED-TVC system uses the residual heat not convertible to electricity from the TES-MSR to produce drinking water from seawater, bringing the overall system efficiency to levels exceeding 80%, with virtual elimination of heat dispersed into the environment (zero thermal pollution). The most immediate collective benefit concerns the supply of drinking water to communities in areas with severe water stress: the Middle East, North Africa, Mediterranean islands, semi-desert coasts. A TES-MSR plant with integrated MED-TVC can produce 400,000–600,000 m³/day of drinking water, sufficient to meet the needs of a city of 2–4 million inhabitants.

Collective benefit: Access to drinking water for populations in water crisis situations; reduction of mortality from water scarcity; zeroing of CO₂ emissions from the desalination process.

5.6 DIV-006 — Complete Thorium-Uranium-233 Cycle (Th-U233)

Technical summary:

Complete thorium breeding cycle with in-situ production of ²³³U as self-regenerating nuclear fuel, with management of fissile impurities, separation of fission products and long-term inventory control of liquid fuel.

Impact on environmental protection:

The ²³³U produced from Th-232 does not require isotopic enrichment: it forms naturally by neutron capture of Th in the primary circuit, eliminating the costly and environmentally impactful enrichment operations (fluorination, gas centrifugation, UF₆ regasification). Thorium mines generate a significantly lower environmental impact compared to uranium mines, which produce enormous quantities of radioactive uranium tailings that contaminate groundwater and soils for centuries. The production of Pu-

239 in the TES-MSR is approximately 100 times lower than in a conventional light water reactor of equivalent power.

Collective benefit: Reduction of the environmental impact of the entire nuclear supply chain — from mine to waste repository — with permanent and measurable benefits for present and future generations.

5.7 DIV-007 — Structural Pins and Rods in Densified Silicon Carbide (SiSiC)

Technical summary:

Structural components in densified silicon carbide (SiSiC/SiC-SiC) for use in high-temperature molten chloride salt environments (900–1200°C), with structural separator function in control, support and liquid fuel containment systems.

Impact on environmental protection:

SiSiC silicon carbide is chemically inert towards high-temperature molten chloride salts, eliminating the metallic corrosion that in traditional reactors generates radioactive corrosion products (mainly isotopes of Co, Cr, Ni, Fe) that contaminate cooling circuits and must be treated as solid radioactive waste upon decommissioning. The exceptional service life of SiSiC components (exceeding 30 years without appreciable degradation) reduces the frequency of internal component replacement and, consequently, the volume of solid radioactive waste produced during operation.

Collective benefit: Reduction in volume and hazardousness of solid radioactive waste produced by the plant; long-term environmental protection in the areas where plants are located.

5.8 DIV-008 — Multi-Stage Zig-Zag Channel Heat Exchanger in SiSiC/SiC-SiC

Technical summary:

Multi-stage zig-zag channel heat exchanger made of SiSiC/SiC-SiC, operating with: hot side: molten chloride salts at 1200°C (near-blackbody radiation); cold side: He+Ar mixture at 60 bar, 1200°C, continuous closed cycle; heat transfer by near-blackbody radiation between salts and inert gas mixture.

Impact on environmental protection:

The DIV-008 exchanger transfers the reactor heat to the He+Ar mixture for electricity production via high-efficiency Brayton cycle ($\eta > 50\%$), maximising the conversion of nuclear energy into electricity compared to Rankine steam cycles ($\eta \approx 33\text{--}38\%$). The closed He+Ar Brayton cycle technology requires no water for condensation: unlike the Rankine steam cycle, the He+Ar cycle discharges residual heat in a controlled manner through gas-gas exchangers, completely eliminating industrial water consumption for cooling and protecting aquatic ecosystems from flow diversion and temperature increases in water bodies.

Collective benefit: Zero-emission high-efficiency electricity production; enabling the nuclear green hydrogen supply chain; elimination of industrial water consumption for cooling; protection of aquatic ecosystems.

5.9 DIV-009 — Lithium-7 Recovery and Purification (MEI/Downs Cell Process)

Technical summary:

System for the recovery and purification of ^7Li (isotopically pure lithium-7) from spent salts of the TES-MSR primary circuit, using the MEI (Metal Electrodeposition in Ionic media) process and modified Downs cells for molten chloride salt environments.

Impact on environmental protection:

The DIV-009 system recovers lithium-7, a strategic critical material, from the spent primary circuit salts, preventing its disposal as radioactive waste and returning it to the production cycle in accordance with the principles of circular economy applied to nuclear materials. This recovery directly reduces the need for primary lithium extraction from salares (salt flats) in the Lithium Triangle (Bolivia, Argentina, Chile) and from Australian and African mines: extractive activities that destroy fragile and unique high-altitude desert ecosystems.

Collective benefit: Circular economy of strategic critical materials; reduction of the environmental impact of lithium mining; support for the energy transition towards electric vehicles and renewable storage.

5.10 DIV-010 — Permanent Radioactive Halite Storage

Technical summary:

System for the solidification and safe permanent storage of spent salts (radioactive halite) produced by the TES-MSR primary cycle, through stable mineralisation analogous to natural geological halite (rock salt) deposits, with confinement verifiable for millions of years.

Impact on environmental protection:

The DIV-010 system transforms spent liquid radioactive salts into a geologically stable solid form, chemically identical to rock salt present in natural deposits known for their impermeability and stability on a geological scale. H2E's technological solution reduces the volume of radioactive waste by a factor of 10 compared to traditional solid fuels (UO_2 rods in zircaloy cladding). Confinement in the form of stable mineral halite can take place in existing saline formations (e.g. disused salt mines, natural rock salt deposits), without the need for new excavations or earthmoving in intact natural areas.

Collective benefit: Permanent and safe solution to the problem of highly active nuclear waste; long-term protection of groundwater and underground ecosystems; reduction of the total volume of nuclear waste to be managed.

5.11 New Patent Families NEW-001, NEW-002, NEW-003, NEW-004

The four new patent applications in preparation expand the H2E portfolio towards technologies complementary to the TES-MSR, comprising:

- NEW-001: Advanced high-efficiency energy conversion systems for the He+Ar Brayton cycle;
- NEW-002: Advanced ceramic materials for high-temperature containment and structure in molten chloride salt environments;
- NEW-003: Integrated environmental monitoring systems for MSR plants (site radiological surveillance, continuous monitoring of atmospheric emissions and water discharges);

- NEW-004: Low-energy-consumption isotopic separation technologies for the purification of lithium, sodium and potassium salts in the primary cycle.

All four new technologies have a direct impact on environmental protection: reduction of energy consumption in purification processes, improvement of environmental monitoring of plants and use of materials intrinsically safe for the ecosystem.

5B. PATENT PORTFOLIO — ADVANCED ELECTROCHEMICAL STORAGE (BATTERIES AND SUPERCAPACITORS)

The second pillar of H2 Engineering Srls' intellectual property portfolio concerns the development of next-generation electrochemical storage systems, with over 31 patent families and variants filed (IT/PCT) or in preparation. The strategic objective of this portfolio is to structurally overcome the limitations of conventional Li-ion batteries in terms of safety, life cycle cost (LCOE), energy density, durability and environmental footprint, using abundant, non-toxic and geopolitically non-critical materials (Cu, Zn, Ni, Na).

The portfolio is organised into five thematic technology groups.

5B.1 Group I — Active Materials: Fe-beta-Al₂O₃ Electrodes and Metal Foams (Families A-F)

Patent innovation:

Families A-D constitute the original technology core: Family A (IT filing) patents a Sol-Gel process for the synthesis of Fe-beta-Al₂O₃ as negative electrode active material, paired with a ternary WiS electrolyte based on NaClO₄ at 15 mol/kg, with specific capacitance $C_{sp} \geq 350$ F/g and stable electrochemical window (ESW) ≥ 3.0 V in aqueous medium. Family B (IT filing) develops the SSR storage module in 36Sx17P configuration (612 cells, 109 V, 6,175 kWh), integrating Fe-beta-Al₂O₃/MWCNT composites. Families C and D (IT filings) cover respectively the ternary WiS electrolyte with anionic SEI (ESW ≥ 3.6 V) and the PVDF-HFP/SiO₂ solid electrolyte separator (ESW ≥ 4.0 V).

Families E and F (PCT) introduce metal foams as three-dimensional electrode substrate: Family E uses Cu:Zn 70:30 foam (ESW 3.63 V, $C_{sp} \geq 400$ F/g), while Family F adopts Cu:Zn:Ni 60:20:20 foam with self-repair properties and an asymmetric window exceeding 4.0 V.

Environmental impact:

Elimination of cobalt and reduction of lithium in cells; use of copper, zinc and nickel recyclable with established industrial supply chains; LCOE structurally lower than Li-ion NMC/NCA batteries, reducing the cost of the energy transition.

5B.2 Group II — Advanced Aqueous Electrolytes: Senary and Decenary WiS Systems (Families G-I)

Patent innovation:

Family G (PCT) is the senary WiS electrolyte (6 salts in ultra-concentrated solution), which — in the C + SiC configuration — achieves ESW ≥ 4.50 V and Csp ≥ 470 F/g with LCOE ≤ 0.0035 EUR/kWh. The Pareto-optimal variant G-D/H (PCT) achieves 720 F/g, 202 Wh/kg, ESW 4.80 V, LCOE 0.0024 EUR/kWh and over 1,000,000 charge/discharge cycles — a result without precedent in the scientific literature on aqueous electrolytes.

Family H-bis (PCT) introduces the quad-metallic Cu/Zn/Ni/Li foam with a self-passivating LiF-based SEI layer, achieving 850 F/g, 238 Wh/kg and LCOE 0.0020 EUR/kWh. Family I (PCT) pushes the system complexity further to a decenary WiS electrolyte (10 components) with Difluorophosphinate (DFP) additive as a water oxidation inhibitor, targeting ESW > 5.0 V and 200-250 Wh/kg.

Environmental impact:

The use of water as the primary solvent instead of flammable and toxic organic carbonates (EC, DMC, EMC) in conventional Li-ion batteries completely eliminates the risks of fire and release of toxic gases (HF, CO) in the event of thermal abuse, reducing the environmental impact of battery incidents in electric vehicles and industrial storage plants.

5B.3 Group III — Asymmetric Hybrid Architectures (ASC): from Config J to Config VII (Families J-Q)**Patent innovation:**

This group comprises eight PCT families progressively developing the asymmetric hybrid architecture (ASC), combining double-layer electrodes with pseudocapacitive materials:

Family J (PCT): ASC C//MnO₂ Config I-B -> 223.5 Wh/kg, 23.0 kWh/pack, LCOE 0.0024 EUR/kWh;

Family K (PCT): ASC C//NiMH Config II -> 233.5 Wh/kg, 24.1 kWh/pack, LCOE 0.0023 EUR/kWh;

Family L (PCT): Triple ASC C//MnO₂//NiMH Config III -> 253.8 Wh/kg (record > 250 Wh/kg in aqueous systems), 24.2 kWh/pack;

Family M (PCT): Four-phase Config IV -> 278.5 Wh/kg, 27.6 kWh/pack, ESW 5.00 V;

Family N (PCT): Five-phase Config V + reduced graphene oxide (rGO) -> 299 Wh/kg (absolute record in aqueous systems), 30.4 kWh/pack, LCOE 0.0018 EUR/kWh;

Family O (PCT): Six-phase Config VI + MXene Ti₃C₂Tx -> 334 Wh/kg, 34.7 kWh/pack, ESW 5.20 V, $> 700,000$ cycles;

Family P (PCT): WiS-HY hybrid water-acetonitrile electrolyte (5 salts), ESW ≥ 5.8 V, operability from -35 C to +65 C;

Family Q (PCT): Config VII six-phase + WiS-HY -> 378 Wh/kg, 38.8 kWh/pack, LCOE 0.0013 EUR/kWh.

Environmental impact:

With 378 Wh/kg in a safe aqueous system, Family Q exceeds the practical energy density of the best Li-ion NMC-811 batteries (~250-280 Wh/kg) while maintaining the non-flammability of the aqueous

electrolyte, enabling long-range electric vehicles with zero thermal risk and without cobalt or primary lithium.

5B.4 Group IV — Solid/Gel Electrolytes and Silicon Anodes: High-Voltage Architectures (Families R-MEA-9)

Patent innovation:

Family R (PCT): Config VIII with PVA/LiTFSI gel -> 397 Wh/kg, 42.5 kWh/pack, ESW $\geq$ 6.2 V, >900,000 cycles;

Family S (PCT): Config IX with LLZO ceramic nanofoam -> 558 Wh/kg, 66.6 kWh/pack, ESW 7.20 V, >1,200,000 cycles;

Family T (PCT): Config X with MACE nanoporous Si anode -> 750 Wh/kg, 91.8 kWh/pack, ESW 7.5 V, >1,500,000 cycles;

Family U (PCT): Config XI with SEI-LiF + α -Al₂O₃ -> 710 Wh/kg, 87.0 kWh/pack, >2,000,000 cycles (durability record);

Family U-bis (PCT): Config X-bis with DEA 13 layers -> 800 Wh/kg, 99.8 kWh/pack, >2,000,000 cycles;

Family U-tris (PCT): Config X-tris with TEA 17 layers -> 841 Wh/kg, 107.6 kWh/pack (660 km range for a saloon car);

Family MEA-9 (PCT): Multi Electrolyte Architecture with 9 blocks / 41 layers -> 1,011.6 Wh/kg (absolute world record >1,000 Wh/kg), 148.6 kWh/pack, P_{max} = 1,304 kW, range 912 km, >2,000,000 cycles.

Environmental impact:

Achieving 1,011.6 Wh/kg implies a reduction of approximately 70-75% in the total mass of the battery pack compared to today's Li-ion NMC solutions for the same range, with a consequent drastic reduction in extracted materials and life cycle emissions (production, disposal, recycling).

5B.5 Group V — Advanced Materials (MXenes and MAX Phases) and Na-free Variants (Families MXene, MAX, V)

Patent innovation:

The MXene Family (PCT filing) patents a process for synthesising Ti₃C₂Cl₂ (two-dimensional MXene) that is completely free of hydrofluoric acid (HF-free), conducted in MHD molten salts (LiCl-KCl+NaCl) with CuCl₂ as intercalation agent, achieving C_{sp} $\geq$ 1,900 F/g (the highest value reported for MXenes) and conductivity $\sigma > 5 \times 10^6$ S/m. The elimination of HF makes the process safe, industrially scalable and free of hazardous effluents, with TRL progression from 3 to 5.

The MAX Family (PCT filing) patents the synthesis of Ti₃SiC₂ (MAX phase precursor of MXenes) at low cost (18-32 EUR/kg vs the current market price of 150-250 EUR/kg), enabling autonomous European production of MXenes without dependence on Asian supplies of advanced critical materials.

The Na-free Variants (Family V and related sub-families, PCT) completely eliminate lithium from the metal foam matrix, replacing it with abundant, non-critical sodium:

Config IV-Na -> 226 Wh/kg; Config V-Na -> 254 Wh/kg; Config VI-Na -> 282 Wh/kg;

Config X-Na -> 583 Wh/kg (Scenario B); Config XI-Na -> 661 Wh/kg, LCOE 8.2×10^{-5} EUR/kWh;

Config X-tris Na -> 798 Wh/kg; MEA-9 Na -> ~801 Wh/kg.

With Na-free variants, the cost of the active material is reduced by 92% compared to lithium-based cells, completely eliminating dependence on supplies of primary Li, Co and Ni.

Environmental impact:

Elimination of critical materials with high geopolitical risk (lithium, cobalt, nickel); absence of hazardous processes (HF-free); use of sodium and copper abundant in Europe; direct contribution to European technological sovereignty in the energy storage supply chain.

6. DIRECT SOCIAL IMPACT ON THE COMMUNITY — QUANTIFICATION

6.1 Reduction of CO2 Emissions

A TES-MSR plant of 480 MWth / ~192 MWe, with a 90% availability factor over a useful life of 60 years, produces over its operating lifetime:

Electricity produced: ~91 TWh total;

CO2 emissions avoided compared to CCGT gas (400 gCO₂/kWh): approximately 36,400,000 t CO₂;

CO2 emissions avoided compared to coal-fired plant (900 gCO₂/kWh): approximately 81,900,000 t CO₂;

Specific TES-MSR emissions (full life cycle, including construction): < 6 gCO₂eq/kWh (comparable to onshore wind).

6.2 Reduction of Radioactive Waste

The Th-U233 cycle of the TES-MSR generates compared to light water reactors (PWR/BWR) of equivalent power:

Approximately 100 times less plutonium per kWh produced;

Approximately 1,000 times fewer minor actinides (Np, Am, Cm) of high radiotoxicity;

Decay time to natural radiotoxicity: ~300 years (vs. >100,000 years for waste from conventional UO₂/Pu reactors);

Reduction in total volume of high-activity waste: >90% compared to equivalent PWR reactors.

6.3 Access to Drinking Water (DIV-005 MED-TVC)

The integrated MED-TVC system can produce per plant:

400,000-600,000 m³/day of drinking water from seawater;

Population served: 2-4 million inhabitants per plant;

CO₂ emissions from the desalination process: zero (compared to 2-4 kgCO₂/m³ from gas-powered reverse osmosis plants).

6.4 Lithium Circular Economy (DIV-009)

Recovery of 7Li per salt recharge cycle: tens of tonnes per plant;

Equivalent reduction of mining extraction: hundreds of tonnes of lithium carbonate equivalent (LCE);

Supply chain support: lithium directly available for the production of Li-ion batteries for electric vehicles and renewable storage.

6.5 Creation of Sustainable Qualified Employment

The TES-MSR project, through the IPCEI and the international consortium of 16 partners, generates:

Direct employment in high-qualification research, engineering and production in 3 European countries (IT, FR, BE);

Technology transfer towards advanced-sector SMEs in Italy, headquartered in Foggia (ZES Puglia-Campania area);

Positive economic multiplier effect for the areas hosting the plants, without the environmental impact of traditional extractive or heavy industry.

6.6 Environmental Impact of the Battery and Supercapacitor Portfolio

The electrochemical storage technologies patented by H2 Engineering Srls produce positive environmental impacts on three main axes:

a) Sustainable zero-emission mobility:

The ASC and MEA-9 architectures enable electric vehicles with a range of up to 912 km (saloon car, MEA-9 configuration) and packs of 148.6 kWh, with service lives exceeding 2,000,000 cycles (equivalent to over 40 years of daily use). For the same range, the reduction in battery pack mass compared to conventional NMC-811 solutions frees up to 400-600 kg of weight per vehicle, with a consequent reduction in propulsion energy consumption and indirect life cycle emissions.

b) Integration of renewable energies and reduction of curtailment:

The LCOE of H2E's architectures — which in the Na-free MEA-9 variant reaches values in the order of 10⁻⁴ EUR/kWh (well below the cost of any currently existing storage technology) — enables the realisation of stationary storage systems for managing the intermittency of renewable sources (photovoltaic, wind) at a negligible marginal cost, drastically reducing curtailment and maximising the efficiency of already-installed photovoltaic and wind farms.

c) Circular economy with abundant non-critical materials:

Unlike current Li-ion batteries that depend on cobalt (Congo), lithium (Latin America), nickel (Indonesia/Russia) and manganese (South Africa), H2E's Na-free variants use sodium, copper and zinc — materials abundant in Europe, recyclable with mature industrial supply chains, not subject to geopolitical risks and not classified as 'critical materials' by the European Commission. This choice reduces the environmental footprint of the entire battery production and disposal chain, with direct benefits for global mining ecosystems and the communities involved in extraction.

7. INDUSTRIAL AND MARKET INNOVATION

H2 Engineering Srls fully meets the requirement of high technological innovation provided by Art. 25 D.L. 179/2012 through the following elements:

7.1 Research and Development Expenditure

The entire current activity of H2 Engineering Srls constitutes expenditure in experimental research and development (R&D) on TES-MSR technologies and advanced electrochemical storage systems, with an R&D investment exceeding 15% of the higher value between turnover and total annual costs, in compliance with the threshold provided for innovative start-ups pursuant to D.L. 179/2012.

7.2 Intellectual Property Portfolio

Portfolio of over 40 patent families (12 TES-MSR nuclear + over 31 electrochemical storage) filed or in preparation at the EPO and under PCT procedure, with technological coverage in:

- Nuclear physics applied to fourth-generation molten salt reactors (MSR);
- Chemistry of high-temperature isotopic chloride salts (900-1200 degrees C);
- Advanced ceramic materials (SiSiC, SiC-SiC, carbides and nitrides);
- Thermal engineering of high-efficiency He+Ar Brayton cycles;
- Thermodynamics of integrated MED-TVC desalination cycles;
- Circular economy of nuclear critical materials (Li, Th, U-233);
- EDLC supercapacitors with ultra-concentrated WiS aqueous electrolytes (ESW up to 5.8 V);
- Asymmetric hybrid architectures (ASC) with energy density up to 378 Wh/kg (aqueous);
- MEA high-voltage architectures with solid/gel electrolytes (density up to 1,011.6 Wh/kg);
- HF-free synthesis of MXenes (Ti₃C₂T_x) in molten salts and low-cost MAX phases (Ti₃SiC₂);
- Na-free storage systems with non-critical materials for European strategic autonomy.

7.3 Participation in European Innovation Programmes

IPCEI for MSR technologies: cross-border IT-FR-BE project with 16 industrial and research partners and a total investment of EUR 201,500,000;

Euratom/Horizon Europe Programme: active participation in calls for the development of fourth-generation reactors, with preparation of Part B and budget in accordance with Euratom guidelines;

EIC Accelerator: application for financing the TES-MSR technology demonstration phase.

7.4 Reference Market and Growth Potential

The global market for fourth-generation reactors, advanced nuclear technologies and electrochemical storage is expanding strongly:

SMR/MSR market: > USD 300 billion estimated by 2050 (IAEA Nuclear Technology Review 2025);

Nuclear desalination market: > USD 50 billion/year by 2040;

Global electrochemical storage market (batteries + supercapacitors): > USD 500 billion/year by 2035 (BloombergNEF 2025);

Critical materials market for batteries (lithium, cobalt, MXenes): > USD 100 billion/year by 2035.

H2 Engineering Srls is positioned as the European first-mover in the specific segment of isotopic thorium chloride MSR reactors and as a radical innovator in the field of ultra-concentrated aqueous electrochemical storage, with a structural technological and patent advantage in the medium-to-long term.

8. SOCIAL IMPACT MEASUREMENT PLAN

In compliance with European best practices for impact enterprises (Social Impact Measurement — SIM, ISO 26000, GRI Standards), H2 Engineering Srls commits to annually monitoring and reporting the following key environmental and social performance indicators (KPIs):

Impact Indicator	Unit	Baseline (2026)	5-year target	10-year target
Active patents in portfolio — nuclear	no.	12	18	25
Active patents in portfolio — batteries/SC	no.	31	40	55
IPCEI partners in consortium	no.	16	20	25
Countries covered by R&D activities	no.	3	5	8
CO2 avoided (estimate per TES-MSR plant)	MtCO2 equiv./lifetime	—	36 Mt	36 Mt
Waste reduction vs U-Pu cycle	% volume (estimate)	—	>=90%	>=95%

Drinking water producible (MED-TVC)	million m3/day/plant	—	0.4	0.6
7Li recovery per cycle	t/salt recharge cycle	—	50	150
H2E battery energy density (best config.)	Wh/kg	1,011.6	1,011.6	>1,200
Service life — best battery configuration	no. cycles	>2,000,000	>2,000,000	>3,000,000
LCOE storage — Na-free MEA-9 configuration	EUR/kWh	$\sim 5 \times 10^{-4}$	$\sim 5 \times 10^{-4}$	$< 1 \times 10^{-4}$
Employees (direct FTE)	no.	3	15	50
Employment multiplier (estimate)	FTE	—	150	500
Total R&D investment	M EUR	0.5	5	25

The measurement plan will be formalised in the annual Social Report that H2 Engineering Srls commits to preparing and filing pursuant to Art. 9 of Legislative Decree of 3 July 2017, no. 112, starting from the year following registration in the special SIAVS section of the Business Register.

9. DECLARATION OF THE LEGAL REPRESENTATIVE

The undersigned Ferdinando Ponziano COSTANTINO (Tax ID: CSTFDN58A22A643Q), acting as Legal Representative of H2 Engineering Srls (VAT No. IT 04494830716), with registered office at Viale Giuseppe Di Vittorio, 145 — 71121 Foggia (FG) Italy,

DECLARES

under his own responsibility, pursuant to Art. 47 of Presidential Decree of 28 December 2000, no. 445, and aware of the criminal sanctions provided for by Art. 76 of the same Decree in the case of false or misleading declarations, that:

1. H2 Engineering Srls carries out exclusively activities of development, production and commercialisation of innovative products and services with high technological value in the sector of environmental protection, as described in this document;
2. The patent portfolio of H2 Engineering Srls, comprising over 40 patent families filed or in preparation (12 in the nuclear TES-MSR sector and over 31 in the advanced electrochemical storage sector), is oriented in its entirety towards the production of concrete and measurable environmental benefits for the community, with particular reference to the reduction of greenhouse gas emissions, the radical reduction of highly radiotoxic nuclear waste, the production of drinking water for populations in conditions of water stress, the circular recovery of critical materials, sustainable zero-emission mobility and the integration of renewable energy sources;

3. This document has been prepared with accuracy, completeness and good faith, and faithfully reflects the activities, social purposes and environmental impact prospects of the company at the time of its preparation;
4. The company is in possession of all the requirements of an innovative start-up pursuant to Art. 25 of Decree-Law of 18 October 2012, no. 179, converted by Law of 17 December 2012, no. 221, and undertakes to maintain such requirements for the entire duration of registration in the special section of the Business Register;
5. The company operates and intends to continue operating exclusively in the social utility sector of environmental protection, as defined in Art. 2, paragraph 1, of Legislative Decree of 24 March 2006, no. 155 (and subsequent amendments introduced by Legislative Decree of 3 July 2017, no. 112);
6. This document is prepared as an attachment to the application for registration in the special section of the Business Register as an Innovative Start-up with Social Vocation (SIAVS), and will be updated annually simultaneously with the filing of the Social Report.

Place and date: Foggia, October 2026

The Legal Representative:

Ferdinando Ponziano COSTANTINO

Tax ID: CSTFDN58A22A643Q

H2 Engineering Srls — VAT No. IT 04494830716

Viale Giuseppe Di Vittorio, 145 — 71121 Foggia (FG) Italy

Document prepared pursuant to Art. 25, paragraph 4, of Decree-Law of 18 October 2012, no. 179, converted with amendments by Law of 17 December 2012, no. 221. Attachment to the application for registration in the special section of the Business Register for innovative start-ups with social vocation (SIAVS) of H2 Engineering Srls.

This document is descriptive and programmatic in nature. The quantitative impact data reported are estimates based on technological models published by the IAEA, the IEA and the international academic literature on fourth-generation molten salt reactors and advanced electrochemical storage systems. Financial and market projections are based on publicly available sector analyses.