HYAFRICA

(15 AUGUST 2022 – 14 AUGUST 2025)

YEAR 1 PROGRESS

LEAP-RE

Long-Term Joint EU-AU Research
and Innovation Partnership on Renewable Energy

Pillar-1 project

The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

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Consortium

One SME (coordinator), 2 research institutes, 5 universities and 1 governamental regulatory body.

Portugal — CONVERGE! I&D Geo-energia e Geofísica

Germany — IAG Leibniz Institute for Applied Geophysics; Fraunhofer IEE

Morocco — Université Mohammed Premier

Mozambique — Universidade Eduardo Mondlane; DNGM Moçambique

South Africa — University of Pretoria; University of Limpopo

Togo — Université de Lomé

Aim of the project

- Map **natural hydrogen resources** in target regions of Morocco, Mozambique South Africa, Togo.
- **Socio-economic impact** assessment and business models in standalone and off-grid systems.
- **Regulatory and roadmap** actions for target countries to engage on natural hydrogen exploration and utilisation.

Relevance vs MAR#3 and MAR#4

- Natural hydrogen is a constant energy source – reliability of power supply
- Local source of energy to isolated communities in stand-alone and off-grid systems
- Reduces energy costs and develops local economies by creating job opportunities.
- No GHG – water is the only by-product. Unlike green H_2, natural H_2 reduces energy-water competition.

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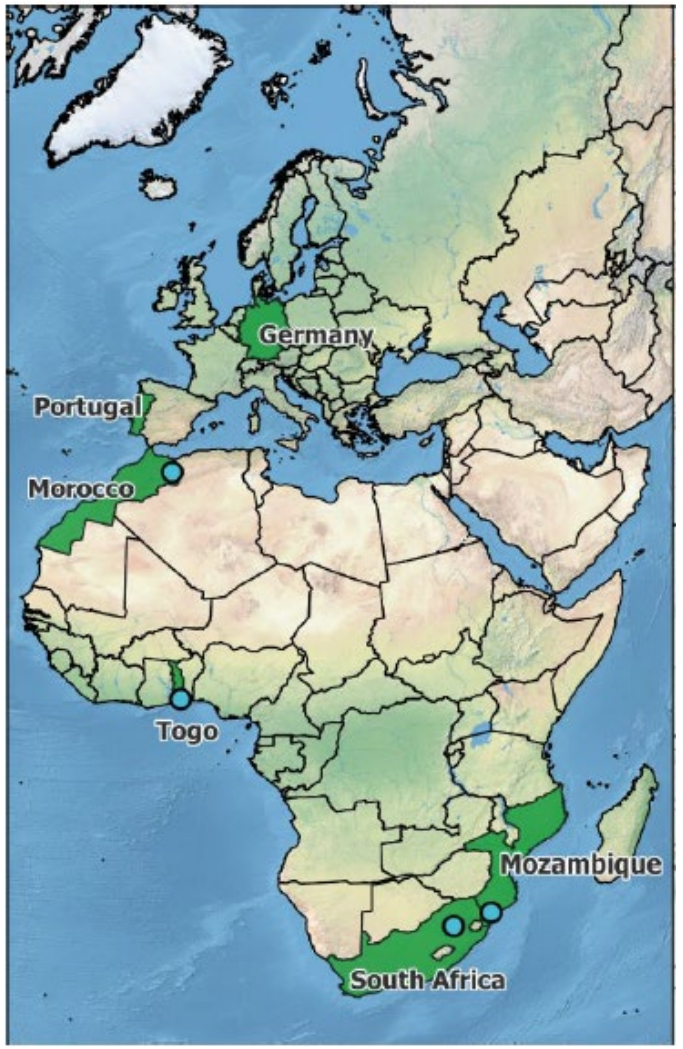
Specific Objectives

i. identify and map exciting resources and increase knowledge about the controlling geological conditions

ii. assess the socio-economic impact and develop business models for standalone, off-grid and mini-grid systems based on H_2.

iii. develop roadmaps for natural hydrogen exploration and exploitation in the target countries.

iv. build awareness of and capacity on natural hydrogen application in standalone and mini-grid systems among the academic community and institutional stakeholders of the target countries.



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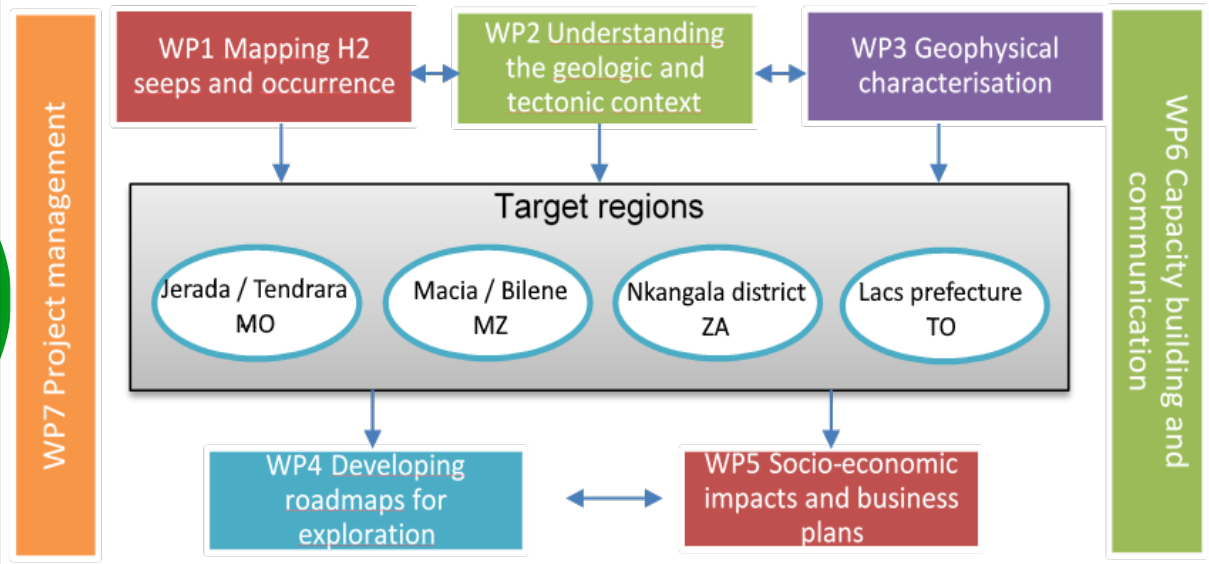

Region characterisation and engagement with stakeholders conducted by Local teams

Methodological approach

Geological and geophysical research - WP1, WP2, WP3

understand the relevant geology and to map the existing resources of natural H_2 and define exploration protocols.

Policy and regulatory analysis – WP4

policy and regulatory analysis to implement regional / national roadmaps for a consistent strategy for natural H_2 exploitation;

Research on local energy systems and their economics - WP5

research on local energy systems and their economics to understand the role of natural H_2 in standalone and off-grid systems in remote or small communities;

Capacity-building strategy - WP6

capacity-building strategy for knowledge transfer and for raising awareness about a novel, renewable, clean energy source amongst decision-makers and other stakeholders of target countries.

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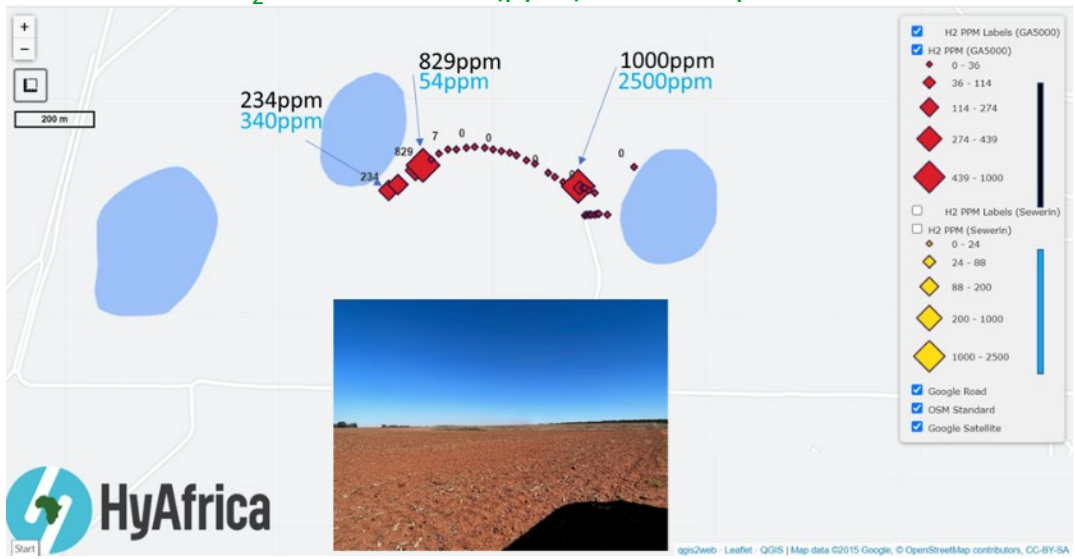
➢ *Results achieved - technical aspects*

i) Remote sensing definition of preferential areas; ii) Conduction of geochemical field studies; iii) Gathering and collection of geological and geophysical data; iv) modelling of geophysical anomalies

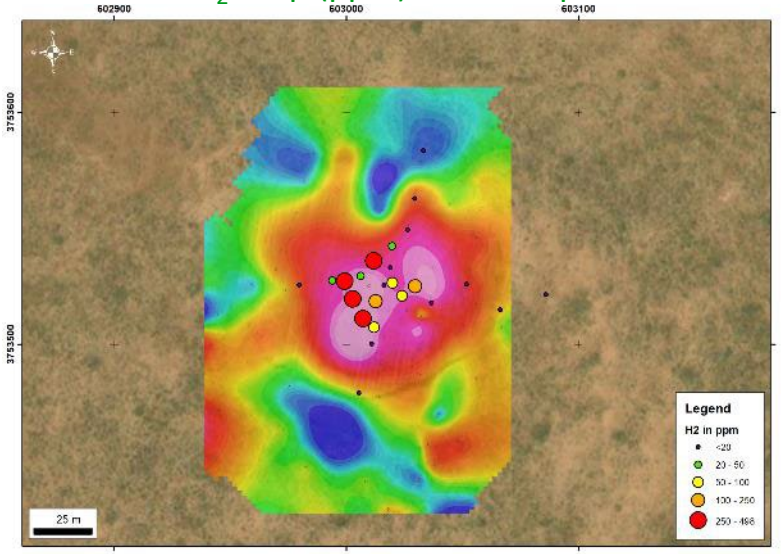
The 1st year of HyAfrica demonstrated that natural H_2 resources exist in two of the target areas:

- Tendrara / Jerada municipalities in Morocco- Identification of **hundreds of H_2 seeps (up to 500 ppm)** and connection with possible **source of H_2 through serpentinization**.
- Nkangala district in South Africa – outstanding results, **up to 1% H_2 concentration at 2 m depth**. More than 1000 *in situ* measurements with H_2 detection. **Confirmed with lab. results**.

South Africa: H_2 concentration (ppm) between pans



Morocco: H_2 seep (ppm) at 1 m depth



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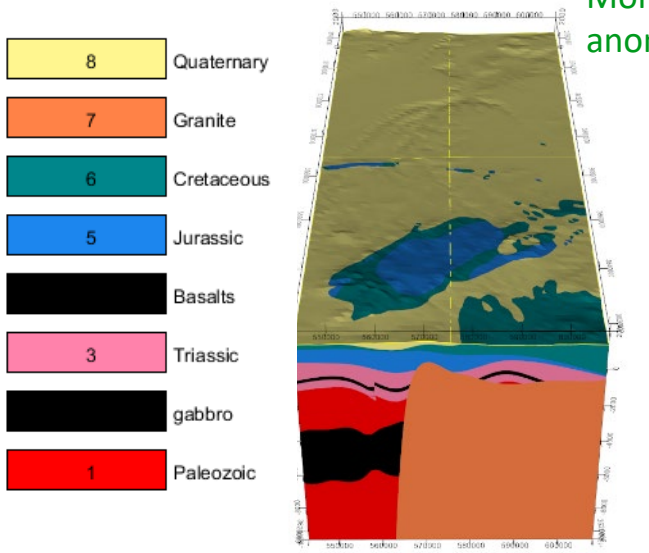
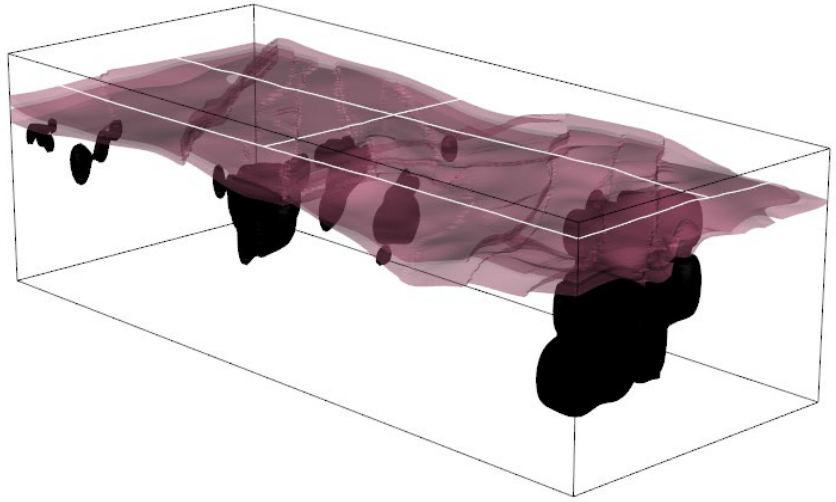
➢ *Progress in comparison with the state of the art*

Preliminary Geological correlation and Geophysical models have been developed:

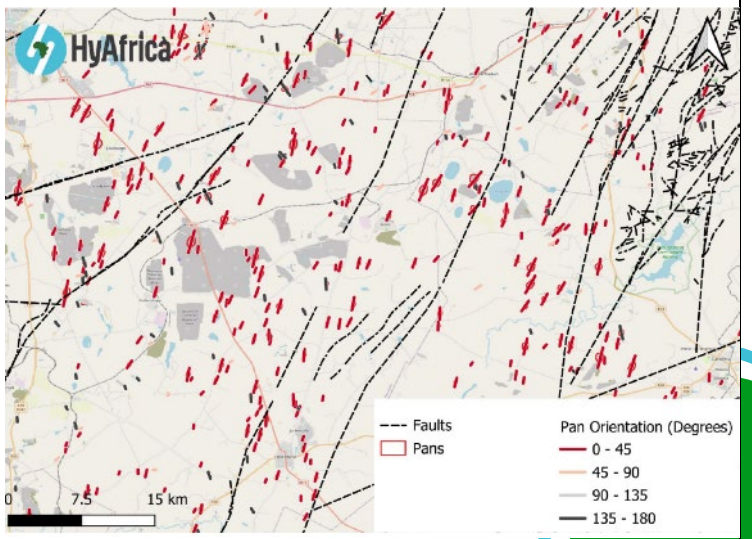
- Morocco – H_2 system seems **related to serpentinization** (as expected); 3D models reproducing mafic rocks source of H_2; model being tuned to estimate H_2 production; indicates that **southern area may have higher potential – field survey under planning**
- South Africa - **H_2 system more productive and with higher potential**, but also much difficult to characterise; **clear control from geological structures (faults)**; may not be related to serpentinization; other sources being considered given the regional geological and structural features (**natural radiolysis; mantle degassing…**);



Morocco: 3D model of magnetic anomaly and possible source of H_2



South Africa: structural control of H_2 seeps



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➢ *Results achieved - building capacity and raising awareness*

- Building capacity workshop for African partners, organised in September 2022, in Casablanca, involving specialists in Natural H_2 from Air Liquide, USGS, Université Grenoble Alpes, the European Federation of Geologists and NH2E (SME).
- Technical building capacity workshops on field exploration (geochemical) for natural H_2 seeps - conducted in Morocco (Feb. 2023) and South Africa (June 2023).
- Workshop “Raising Awareness About Natural Hydrogen” for South African stakeholders , took place 14 of September 2023, in Pretoria, South Africa. Attendees from public and private institutions and sectors including academia, research, mining and energy.
  - Current state of the art in natural hydrogen research,
  - the HyAfrica project,
  - the results of the first HyAfrica field campaign of natural hydrogen exploration in South Africa.
  - discussion regarding national policy requirements and regulatory issues was also held.

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➢ *Results achieved - Interest amongst industry and press visibility*

- Several contacts received from industrial companies (including ENGIE) enquiring about the results and offering to cooperate with the HyAfrica;
- Moroccan national oil and mining company (ONHYM) participated in field survey in the Tendrara region;
- Agreement signed with GETECH on provision of geophysical information for Mozambique and Morocco;
- Hydrocarbon authority in Mozambique has inquired about the project and may be interested in joining the consortium;
- Contacts received from Advisor of *Hydrogen Europe* on the possibility of conducting similar projects in the Sahel countries;
- Contacts with mining companies in South Africa for the possibility to d
- Visibility in highly relevant German press ("Der Spiegel" 04.03.2023, "I interviews with LIAG and IEE Fraunhofer partners;
- Contact received from producer in CNN Africa - interested in joining fie
- Invited to the Mozambique Energy and Industry Summit. H-Series, 8th
- Featured in YouTube channel Breaking Lab (Natürlicher Wasserstoff: Ja

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Possible evolutions of the objectives in progress of the project

- Results in South Africa are already relevant enough to justify advancing more into definitions of *sweet spots* for exploitation of natural H_2.
- Would imply more efforts in technical WP1 to WP2 and pursue connections with industry to conduct expensive geophysical explorations methods in WP3.

Problems encountered during the project

- The Due Diligence requested for the two Mozambican partners, funded through the EU common pot, inadequate for research projects. Serious delay in the work plan for the Mozambique target area – contracts signed in 2023. Field work in WP1 will be conducted with a 9-month delay, at least.
- The lack of funding for the University of Lomé is a serious constraint to conduct the field work. Not yet clear when will the field work be conducted.

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End of project expected results (2025)

- Given that HyAfrica just completed the 1st year and since activities are still to be started in two of the four target areas (Mozambique and Togo) - too early to forecast the evolution of the Consortium;
- However, excellent working relations have already been developed between EU and AU partners.
- During the General Assembly 2023, already looking for other funding opportunities for engaging in joint research on natural H2, particularly for the Moroccan and South African target;
- South African target seems promising enough to start looking for industrial partnerships for systematic exploration and production.

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Expected outputs	Outcomes
• Identify resources in 4 promising regions; • Ranking of areas with potential for H_2; • Techno-economic analysis of natural H_2 in every system of 2 most promising regions; • First local/regional Business models for natural H_2 utilization; • Comparative analysis and complementarity of natural H_2 and green H_2 and other RES; • Framework for including natural H_2 energy and mining laws of four target countries; • Roadmaps for implementing natural H_2 exploration and exploitation in target countries; • Capacity building and raising awareness on H_2; • IPR for methodology for exploration of natural H_2.	• At least 2 regions implement an exploration and utilization program; • At least 2 countries include natural H_2 in the national mining and energy laws; • At least 2 countries implement programs for the characterisation of national resources in natural H_2; • Business models for standalone systems with H_2 (natural or green) are validated in the target regions; • 2 most promising regions plan to increase the share of RES and promote sustainability using H_2; • Academics, policymakers in the mining and energy sector and entrepreneurs in the 4 target regions acquire knowledge on natural H_2 and green H_2 in energy systems; • Increase research capacity about H_2-based systems of target countries will result from a multidisciplinary component of the project and building capacity activities; • Communication at local and regional level increase local population engagement.

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Expected outcomes (2030)

Regional scale

1. At least 2 regions implement natural H_2 exploration and utilisation programmes;
2. At least 2 regions increase the share of RES and promote sustainability by using natural H_2;
3. Business models for standalone systems with H_2 (natural or green) are validated in the target regions;
4. Communication at local and regional level increase local populations engagements.

Country scale

1. At least 2 countries include natural H_2 in the national mining and energy laws;
2. At least 2 countries implement programs for characterisation of national resources in natural H_2.

Which main risks of failure during project implementation ?

1. **Inability to solve problems to conduct the field work in Mozambique and specially in Togo**
2. Limited commercial viability of the use cases (not enough H_2 resources, cost of infrastructure, …);
3. Difficulty to engage regional / national policy makers and stakeholders to develop regulatory frameworks;
4. Difficulties in collecting data about local energy systems and for socio-economic analysis;

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Contribution of the project to AU – EU R&D cooperation

1. African and Europe researchers involved in new industrial branch on a hydrogen base economy,
2. Reinforced joint African and European scientific basis and export potential for a new primary energy source.
3. Europe and Africa as frontrunners in the natural hydrogen industry and provide EU and African companies the opportunity to lead its exploration, exploitation and purification.

Interest of Consortium members in participating in LEAP-RE clustering activities

1. Connection to MAR#1, MAR#3 and MAR#4.
2. Capacity building for public officers and institutional representatives
3. Acquisition of data on socio-economic conditions, energy demand and energy supply
4. Socio-economic modelling
5. Resource availability and energy supply chain.

THANK YOU

CONTACT US FOR MORE INFORMATION

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