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Project acronym: JUST-GREEN AFRH2ICA

Project title: Promoting a JUST transition to GREEN hydrogen in AFRICA

Type of action: Deployment of systemic solutions with the support of local clusters and the development of regional community-based innovation schemes

D3.3 "JGA Final SRI"
WP3 "Impact Assessment of Modelled Scenarios and Roadmaps Development"

T3.1 "Definition of African hydrogen roadmaps leveraging modeling results towards 2030-2050"

WP leader "AHP"

Delivery type:	Report
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Project Title	Promoting a JUST transition to GREEN hydrogen in AFRICA
Project Acronym	**JUST GREEN AFRH2ICA**
GA n.	101101469
Project Coordinator	**UNIGE**
Project Duration	24 months
Deliverable n.	3.3
Deliverable title	JGA Final SRI
Deliverable description	Wrap up of WP3 roadmaps and project results
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Version	Date	Author/Contributor	Changes
1	11/11/2024	UNIGE	Project Legacy Presentation
2.	16/01/2025	UNIGE	ToC and Draft Discussed during the General Assembly
3.	31/01/2025	UNIGE	Final Draft for Submission

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JUST-GREEN AFRH2ICA

EXECUTIVE SUMMARY

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101101469

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This document presents Deliverable 3.3 “JGA Final SRI“ developed within WP3 of the JUST GREEN-AFRH2ICA project of the JUST-GREEN AFRH2ICA Project under UNIGE leadership.

This strategic roadmap wraps up the main outcomes of the project and the project vision and legacy that the project built up along 24 months of activities performed by the consortium with the relevant support of African Stakeholders

The roadmap wraps up outcomes coming from the other WP3 roadmaps (and particularly D3.1 and D3.2), trying to sum up the list of interventions and actions proposed in such documents in 10 key actions (with specific targets to 2030 and 2050 per each of them) that could enable the setup of a JUST green hydrogen transition in Africa that could from one side unlock African green hydrogen potential and from the other side make Europe key interlocutor for such transition from a technological, investment and import point of view.

Such 10 key actions were presented in a “FINAL PROJECT LEGACY PRESENTATION” during the two final stakeholders events in Brussels during the Hydrogen Week 2024 in November 2024 and in Rabat in January 2025, for the final project event.

Such presentation has been also introduced among the contents of the Training Package 2 on the project E-Learning Platform.

Together with D3.1 and D3.2, the Final JGA SRI has the goal of proposing:

1) a set of targets to be reached per each time horizon in terms of electrolysis capacity

to be installed (and manufactured) in Africa;

2) a list of more strategic countries (also following up WP1 results) where to start the African Hydrogen transition)

3) a set of policies and interventions to overcome non-technical barriers that could hinder to achieve foreseen targets (mostly in terms of know-how targets and regulatory/permitting barriers to be solved)

4) a set of actions that EU should put in place to facilitate Green Hydrogen Transition.

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1. Introduction

This roadmap serves can be considered as the final result of the JUST-GREEN AFRH2ICA project to guide policy makers, national bodies, transnational associations, investors, green hydrogen project developers and all green hydrogen stakeholders active in Africa in order to realize precise actions and steps towards the setup of a real African Green Hydrogen Economy and an actual Green Hydrogen Mutual Benefit collaboration between Africa and Europe.

Wrapping up project results and thanks to inputs collected from project stakeholders, this document has the ambition to set a pathway that can ensure that Africa's hydrogen economy can flourish in a way that is globally competitive and also locally beneficial, being JUST and sustainable for African environment, economy and society.

Hence, it will guide the JUST-GREEN AFRH2ICA project to promote sustainable development by enhancing local hydrogen use in the AU member nations and positions Africa as a hydrogen economy hub by 2050 without compromising on domestic needs or inspiring colonization.

At the same time this roadmap will promote Europe as the main interlocutor of this African green hydrogen transition, making Europe effective supporter of African green hydrogen projects facilitating access to funding instruments, know-how and technologies.

In common with D3.2**, t**he roadmaps presented in this report is structured around three major phases, a "Timeline overview":

- building of foundational aspects (at policy, know-how and lighthouse project development level) for African green Hydrogen economy development by 2030
- scaling of infrastructure, manufacturing and market capacity by 2040 also strongly increasing the electrolysis capacity to be installed in the continent
- achieving full integration of the continent's hydrogen value chain with global markets by 2050, making Africa as the continent with the higher green hydrogen production at global level and with a hydrogen production fully decarbonised (Hydrogen is produced in Africa only via Electrolysis).

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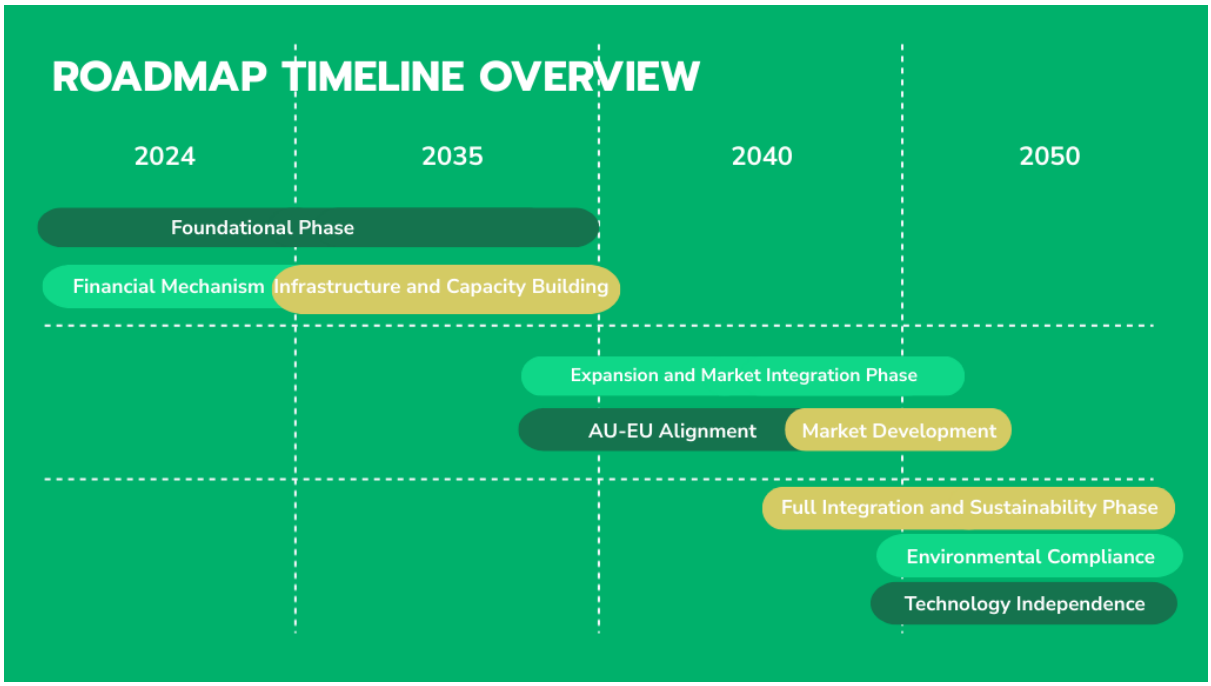

Figure 1 Policies Timeline Overview

Milestone Year	Key Focus Areas	Goals and Milestones
2030	Foundational Phase	Policy Foundations: Establish regulatory frameworks for green hydrogen projects, including emissions targets, water management, and local benefit mandates.
	Financial Mechanisms	Funding and Incentives: Launch the Green Hydrogen Investment Fund and develop blended financing models. Introduce tax incentives for local hydrogen production and usage.
	Infrastructure	Initial Infrastructure: Develop pilot hydrogen hubs, storage facilities, and initial trade zones to streamline hydrogen production and distribution.
	Capacity Building	Skills Development: Partner with local and international institutions to create training programs, building hydrogen expertise including technical, management, digital, ecosystem, and societal skills within AU countries.
2040	Expansion and Market Integration Phase	Production Scale-Up: Expand hydrogen production and infrastructure to meet both domestic demand and export potential, with enhanced technology and capacity in AU regions.
	AU-EU Alignment	Certification and Trade Policies: Implement AU-EU harmonized certification standards, zero-tariff trade agreements, and dedicated hydrogen export zones at key ports.

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	Market Development	Domestic Demand Growth: Increase local hydrogen adoption in industry and transportation, supporting climate goals and reducing fossil fuel dependency.
2050	Full Integration and Sustainability Phase	Balanced Hydrogen Economy: Achieve 50% hydrogen distribution between domestic use and export, ensuring long-term economic resilience and energy independence in AU regions.
	Socioeconomic Impact Standards	Sustainability Targets: Ensure that all hydrogen projects meet carbon-neutral standards and sustainable water and land use practices, in full alignment with AU-EU policies.
	Technology Independence	Local Manufacturing: Establish local production for hydrogen technology components, including electrolysers and fuel cells, to support a self-sustaining green hydrogen sector.

Table 1. Project Timeline – 2030, 2040, 2050 Goals and Milestones

All in all, JUST GREEN AFRH2ICA roadmaps should target always a JUST TRANSITION approach, thus the promotion of clean technological solutions that have to be sustainable at 360°: economic, environmental and social as represented in Figure 2.

Figure 2 Sustainability Criteria for Green Hydrogen (Outer Circle) and Related Impact Category (Inner Circle)

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Structure of the Deliverable

The reports starts in Chapter 2 via a presentation of the steps that brought to the identification of the 10 KEY ACTIONS that are presented in this Strategic Integrated Roadmap.

In chapter 3 such 10 key actions are presented with specific timeline and targets presented per each of them.

In Chapter 4, following up UNIGE multi-aspects assessment of green hydrogen potential of African countries presented in WP1 deliverables, a list of “strategic countries” where to start the promotion of African Green hydrogen transition is presented.

Relation to Other Tasks and Deliverables

This report wraps up all WP3 tasks, with contents that are purposely not repeated from D3.1 and D3.2. Part of the contents here by reported are presented in D3.1 and in RP2 too.

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2. Stakeholders Interaction towards JUST GREEN AFRH2ICA SRI

2.1 Interaction with LEAP-RE Project

In Late Summer 2024, JUST GREEN AFRH2ICA consortium got in contact with the consortium of LEAP-RE Project (https://www.leap-re.eu /).

The EU-funded LEAP-RE project will create a long-term partnership of African and European stakeholders in government, research and academia, the private sector and civil society. In its mission to develop renewable energy as a sustainable source of energy for all in Africa, the project will work to reduce fragmentation by aligning existing bilateral and multilateral frameworks. It brings together a large-scale consortium of 96 partners from 34 countries and two international organisations.

The work of LEAP-RE is based on 7 themes, which have been identified during the programme preparatory phase, PRE-LEAP-RE. These roadmaps focus on key topics in order to make the development of renewable energy sustainable and efficient: innovation priorities, smart-grid and off-grid systems, productive and domestic uses, access to energy, recycling, etc. They lay the ground for the selection of projects in the LEAP-RE Portfolio

In this framework, the seventh key topics for LEAP-RE is Hydrogen.

Acknowledging the relevance of the work done by the consortium, JUST GREEN AFRH2ICA was interrogated by LEAP-RE in order to support the drafting of the 7th Multi Annual Roadmap dedicated to Hydrogen and recently published by the project (https://www.leap-re.eu/multi-annual-roadmap-7/).

Specific aspects in terms of R&D topic to be promoted also to facilitate long lasting cooperation between Africa and Europe in the field of hydrogen were suggested by JUST GREEN AFRH2ICA Team. Among them:

- the importance of setting up hands on laboratories to facilitate skills development on FCH technologies in Africa
- the relevance of the “Hydrogen Hub” approach with the importance of perfect coupling/sizing green hydrogen production plants with African Industrial hard-to-abate sites
- the relevance of further promote R&D about Natural hydrogen exploration also to make Africa as frontrunner of this technology
- the importance of “knowledge/technology transferring” from “sisters sectors” (O&G, mining, chemical, refineries…) currently strong present in Africa towards the setting up of a full African Hydrogen Manufacturing value chain
- the investigation about how to most effectively transport green hydrogen produced in Africa to Europe, starting from a proper repurposing of existing Natural Gas Pipelines and the promotion of hydrogen carriers (Methanol and Ammonia) as key

solutions both for African industries (fertilizers, formaldehyde production and refineries) and for export

This interaction with LEAP-RE solicitated JUST GREEN AFRH2ICA team to start to think about its own Strategic Roadmap.

2.2 Project Legacy Presentation and final stakeholders survey

In the framework of the Stakeholders workshop organized by JUST GREEN AFRH2ICA consortium in cooperation with Hydrogen Europe in Brussels (Fig.11) on 19th November in Brussels, UNIGE prepared a presentation that had the goal to wrap up WP3 activities and lay on the ground the first contents of D3.3. Such presentation has been named "The project Legacy" and it has been also used for a special recorded lesson introduced as final module in the 2nd E-Learning Package on JUST GREEN AFRH2ICA EduOpen Platform (see D4.2).

Such contents were redacted in the form of a slide deck that has been used from one side to present some key concepts/results of the project that drove project activities such as:

1) the importance of a JUST transition to avoid any risk of perception of green hydrogen investment of a sort of "colonization" of Africa (Fig.1);
2) the relevance of the "Hydrogen Hub" approach as key way to setup green hydrogen bankable projects in Africa and to move from there to create benefits to the local community in the surrounding (Fig.2);
3) the fact that green hydrogen production has not to be seen as threat, but more as an opportunity to facilitate water access in Africa (Fig.3);
4) the fact that African green hydrogen projects currently in pipeline often fail to achieve a certain level of maturity due to the complexity of attracting investments and capitals in a risky sector and geographical/market context; (Fig.4);
5) The importance of increasing African citizens and workforce awareness on green hydrogen opportunities for the contientn (Fig.5) ;
6) The opportunity of decarbonizing products currently manufactured in Africa thanks to green hydrogen and then export higher value clean products in Europe (instead of hydrogen itself) leveraging existing logistic value chains (Fig.6)
7) The fact that EU does not have to reduce or stop its own electrolyser installation roadmap whatever will be the import from Africa (Fig.7), being conscious that exploiting the existing EU Natural Gas transmission system and AU-EU Natural gas connection pipelines will be the most effective way to setup a proper export pathway, particularly in concert with a full EU H2 Backbone initiative (Fig.8)

Following these key take-aways, the presentation introduces two slides were some key actions are proposed, from one side in Africa to unlock its green hydrogen potential (Fig.9) and from the other side in Europe to support African green hydrogen transition and establish a mutual benefit cooperation in this sector between the two continents (Fig.10).

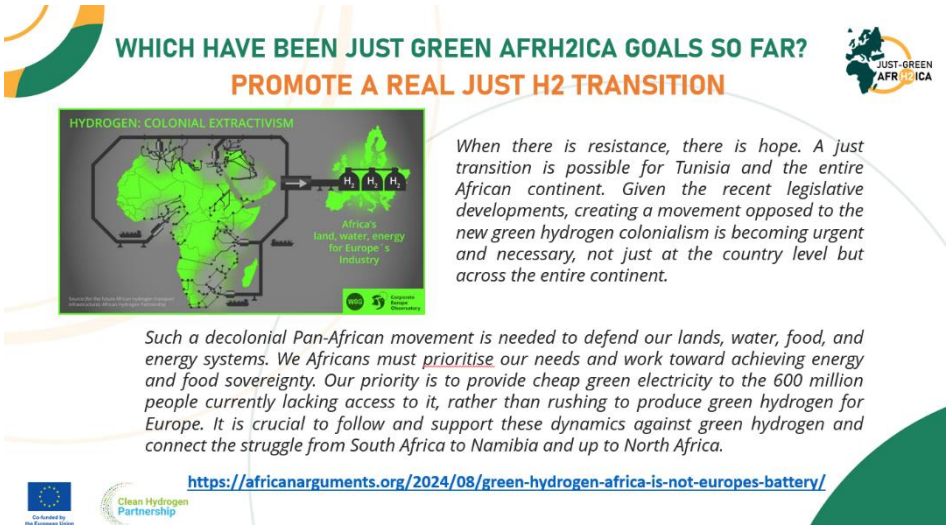

Figure 3 JGA Final Legacy as presented during final event to project stakeholders – The importance of a real JUST transition

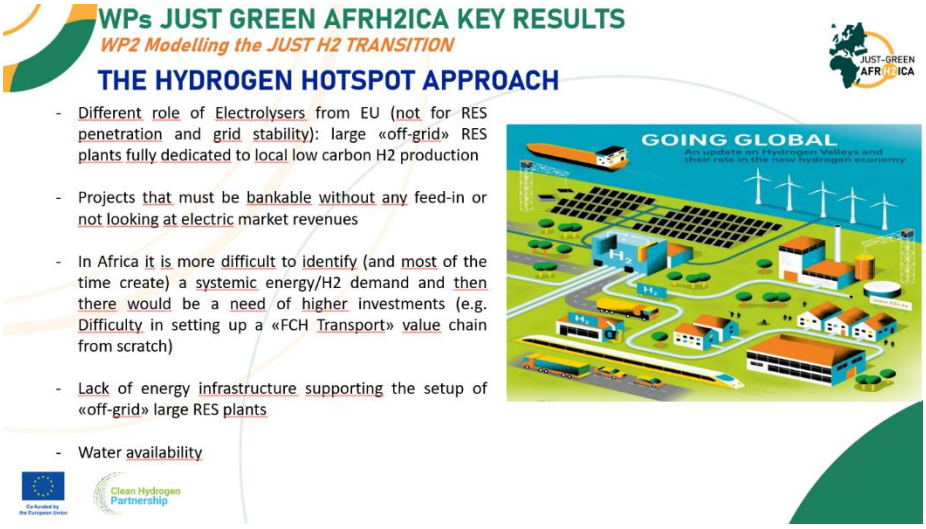

Figure 4 JGA Final Legacy as presented during final event to project stakeholders – The concept of Hydrogen Hubs from JUST GREEN AFRH2ICA Project

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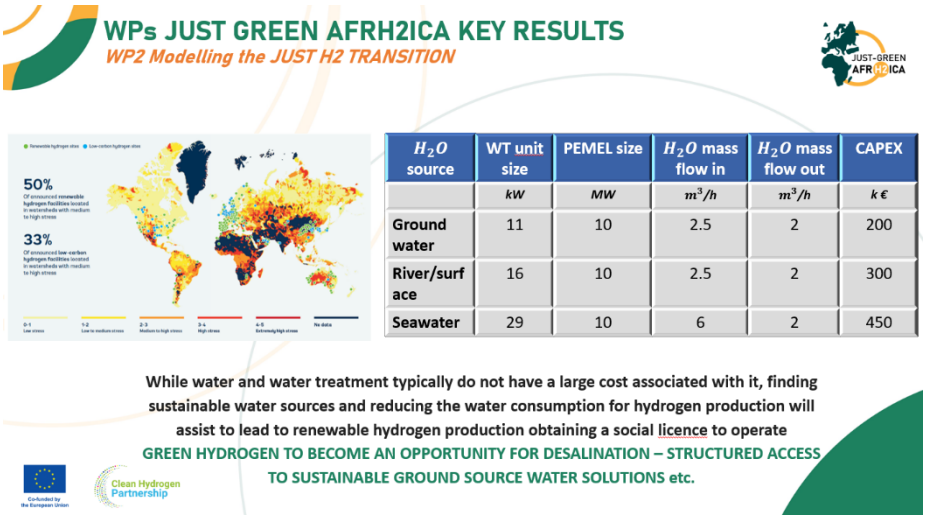

H_2O source	WT unit size	PEMEL size	H_2O mass flow in	H_2O mass flow out	CAPEX
	kW	*MW*	m^3/h	m^3/h	*k €*
Ground water	11	10	2.5	2	200
River/surface	16	10	2.5	2	300
Seawater	29	10	6	2	450

Figure 5 JGA Final Legacy as presented during final event to project stakeholders – Hydrogen as an opportunity for water access in Africa

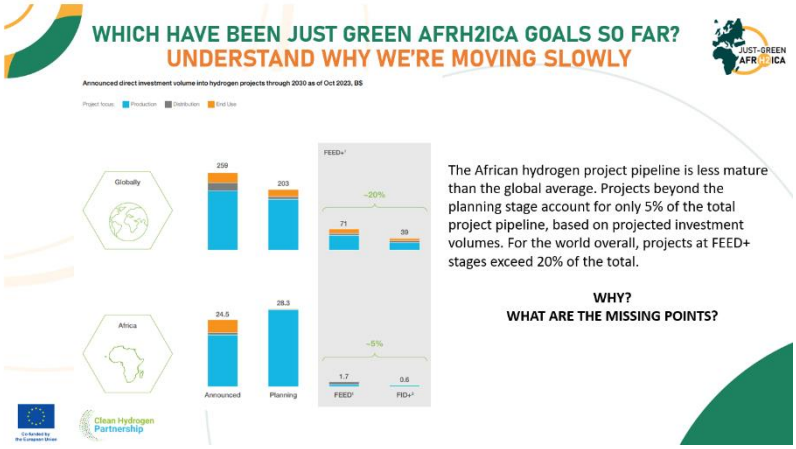

Figure 6 JGA Final Legacy as presented during final event to project stakeholders – The issues of financing green hydrogen projects in Africa

Figure 7 JGA Final Legacy as presented during final event to project stakeholders – The importance of increase African Hydrogen Awareness at 360°

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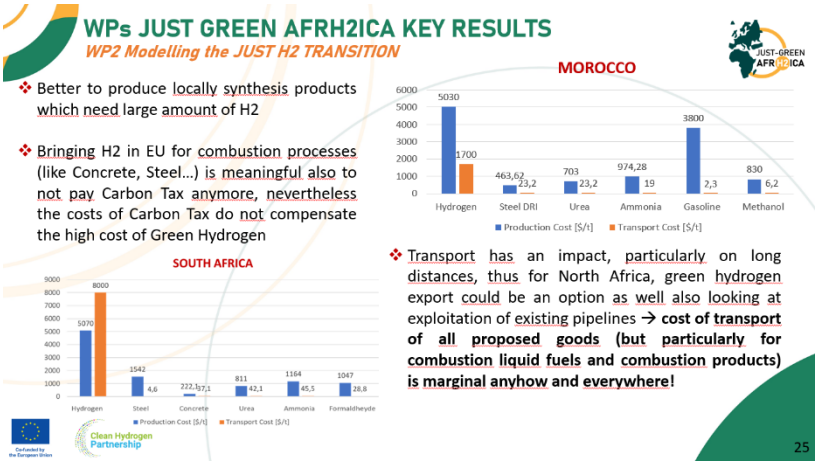

Figure 8 JGA Final Legacy as presented during final event to project stakeholders – The strategicity of exporting "Green Products" instead of Green Hydrogen

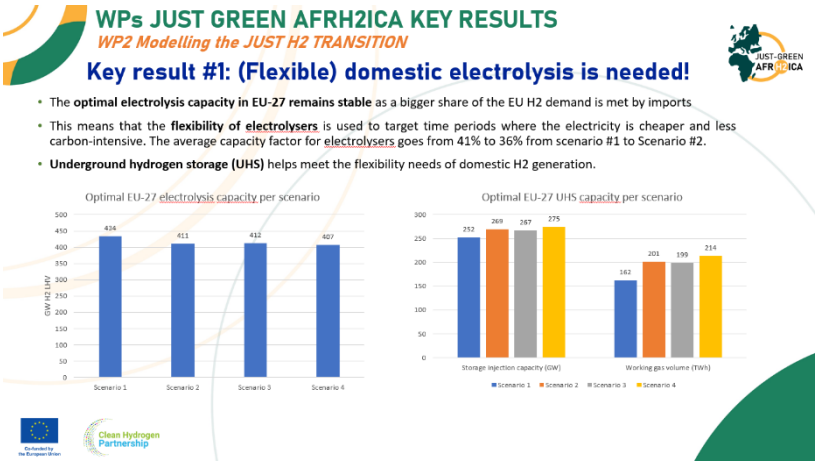

Figure 9 JGA Final Legacy as presented during final event to project stakeholders – No reduction foreseen in EU Electrolyser roadmap whatever will be green hydrogen import from Africa

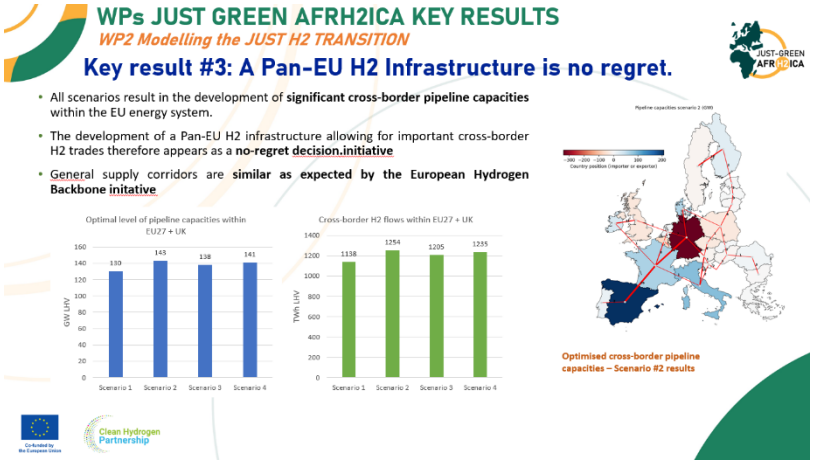

Figure 10 JGA Final Legacy as presented during final event to project stakeholders – The importance of Natural gas pipelines both for H2 Import from Africa and its distribution around EU

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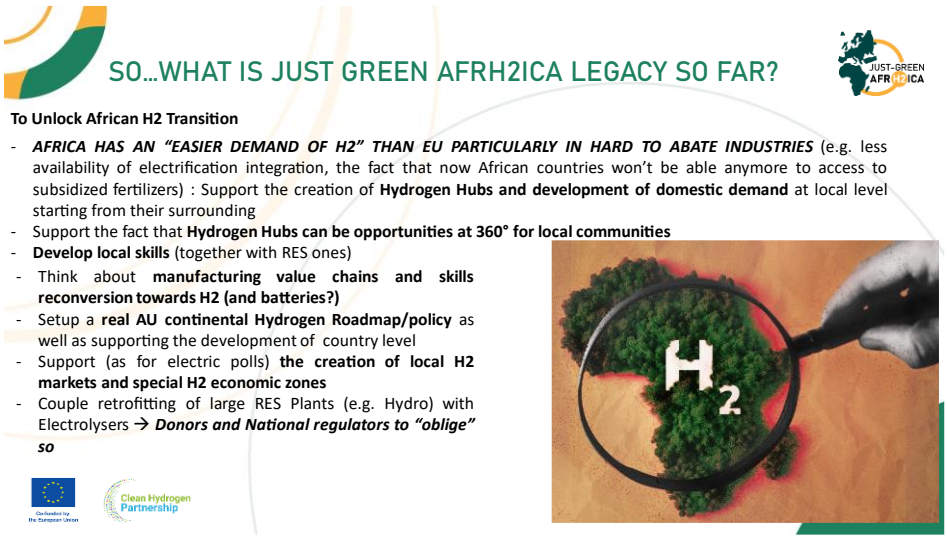

Figure 11 JGA Final Legacy as presented during final event to project stakeholders – Proposition of key actions to be performed in Africa to unlock African Green Hydrogen transition

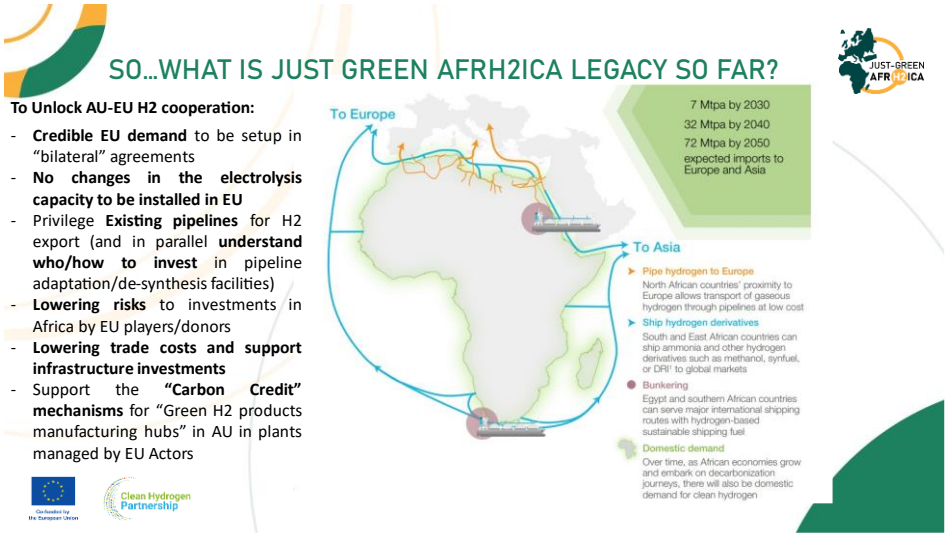

Figure 12 JGA Final Legacy as presented during final event to project stakeholders – Proposition of key actions to be performed in Europe to support a mutual benefit cooperation for the Green Hydrogen sector

Figure 13 Hydrogen Europe introduction by Marie Espitalier Noel during JUST-GREEN AFRH2ICA stakeholders event in Brussels during the Hydrogen Week 2024

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With this presentation the goal of UNIGE as coordinator, has been to wrap up project results towards what has been called “PROJECT LEGACY” which has been included in project official presentation and presented to stakeholders (to collect relevant insights and feedback) during the two final event in Brussels and Rabat. As said such presentation identified a first list of key actions to be performed to:

1) Unlock African Green Hydrogen transition and the setup of a local Hydrogen Value Chain
2) Establish a long lasting collaboration between Africa and Europe in the field of green hydrogen

Such presentation has been presented in Brussels and Rabat final event, collecting inputs via a specific survey[1] that was distributed during the events. 78% of the respondents (24 along the EU event and 19 along the Moroccan one) were aligned with project “main reflections and statements” identifying as the most relevant and burning actions the following ones:

- TO BE PERFORMED IN AFRICA: To setup a real AU continental Hydrogen Roadmap/policy as well as supporting the development of effective and precise H2 policies at country level
- TO BE PERFORMED IN EUROPE: Lowering risks to investments in Africa by EU players/donors

The questions of the survey (that recall the topics presented in the slides) are reported in the following

TO UNLOCK AFRICAN HYDROGEN TRANSITION – Actions to be performed in Africa

JGA project acknowledges that the current highlights/actions are relevant to be considered to strongly support African Hydrogen Transition

1) Africa Has Not Only A Great Hydrogen Production Potential, But It Has An “Easier Demand Of H2” Than EU Particularly In Hard To Abate Industries (e.g. less availability of electrification integration, the fact that now African countries won’t be able anymore to access to subsidized fertilizers) : it's important therefore to support the creation of Hydrogen Hubs and development of domestic demand at local level starting from their surrounding
2) To think about manufacturing value chains and skills reconversion towards H2 (and batteries?)
3) To setup a real AU continental Hydrogen Roadmap/policy as well as supporting the

[1] https://forms.microsoft.com/e/Frdsrr9XW6

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development of country level
4) To support (as for electric polls) the creation of local H2 markets and special H2 economic zones 5) To promote the couple of retrofitting of large RES Plants (e.g. Hydro) with Electrolysers --> Donors and National regulators to "oblige" so
5) To support the fact that Hydrogen Hubs can be opportunities at 360° for local communities
6) To Develop local skills (together with RES ones)

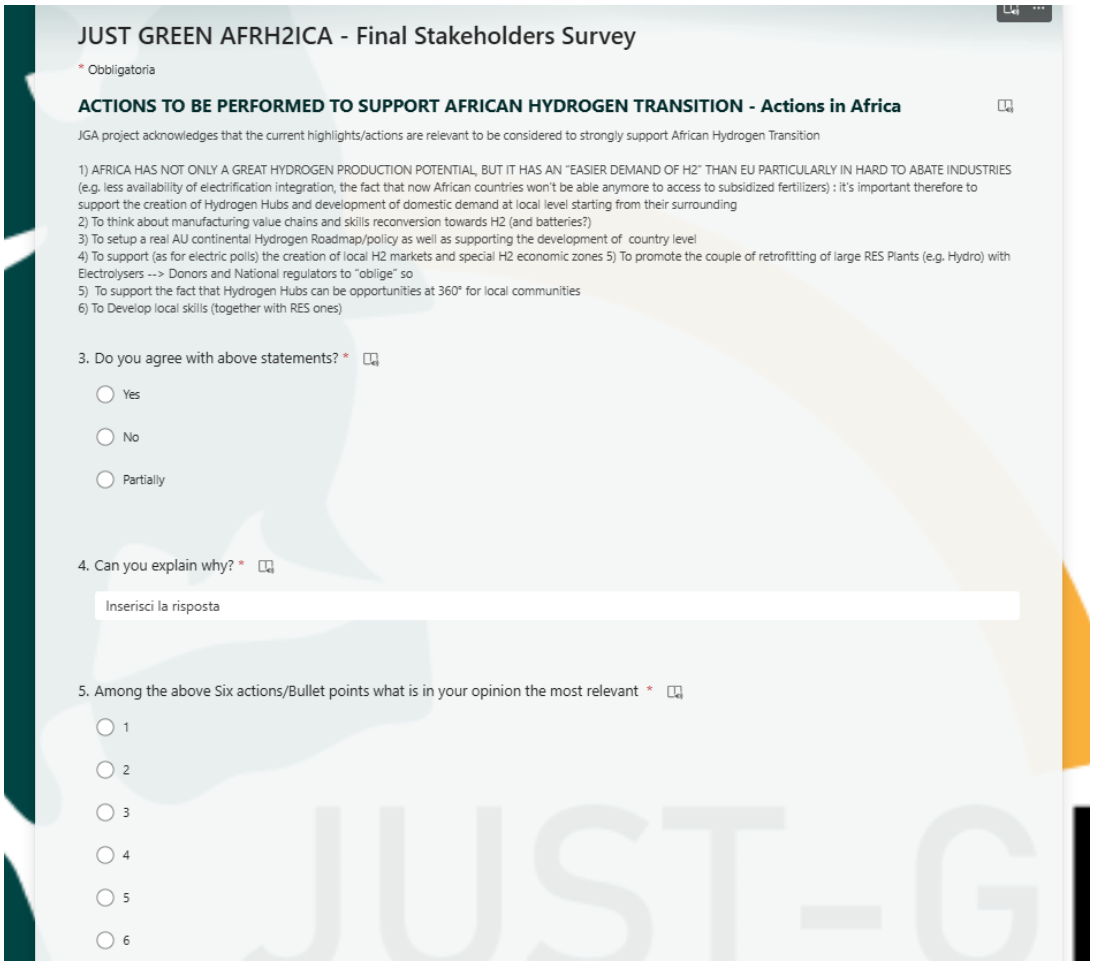

Figure 14 JUST GREEN AFRH2ICA Final Stakeholders online survey – First Part

TO UNLOCK AFRICAN HYDROGEN TRANSITION – Actions to be performed in Europe

JGA project acknowledges that the current highlights/actions are relevant to be considered to strongly support African Hydrogen Transition

ACTIONS TO BE PERFORMED TO SUPPORT AFRICAN HYDROGEN TRANSITION - Actions in Europe

JGA project acknowledges that the current highlights/actions are relevant to be considered to unlock EU-AU Hydrogen cooperation:

1) to identify a credible and quantifiable EU demand to be setup in "bilateral" agreements (with specific end users fully committed for specific H2 quantities yr per yr)

2) whatever will be the import of H2 from Africa, EU has not to change in its electrolysis capacity to be installed in EU

3) it's important to privilege Existing pipelines for H2 export (and in parallel understand who/how to invest in pipeline adaptation or in H2 stripping/de-synthesis facilities)

4) Lowering risks to investments in Africa by EU players/donors

5) Lowering trade costs and support infrastructure investments also enabling the possiility to finance via schemes like IPCEI and Innovation Fund green hydrogen projects in Africa if of relevant EU interest

6) Support the "Carbon Credit" mechanisms for "Green H2 products manufacturing hubs" in AU in plants managed by EU Actors

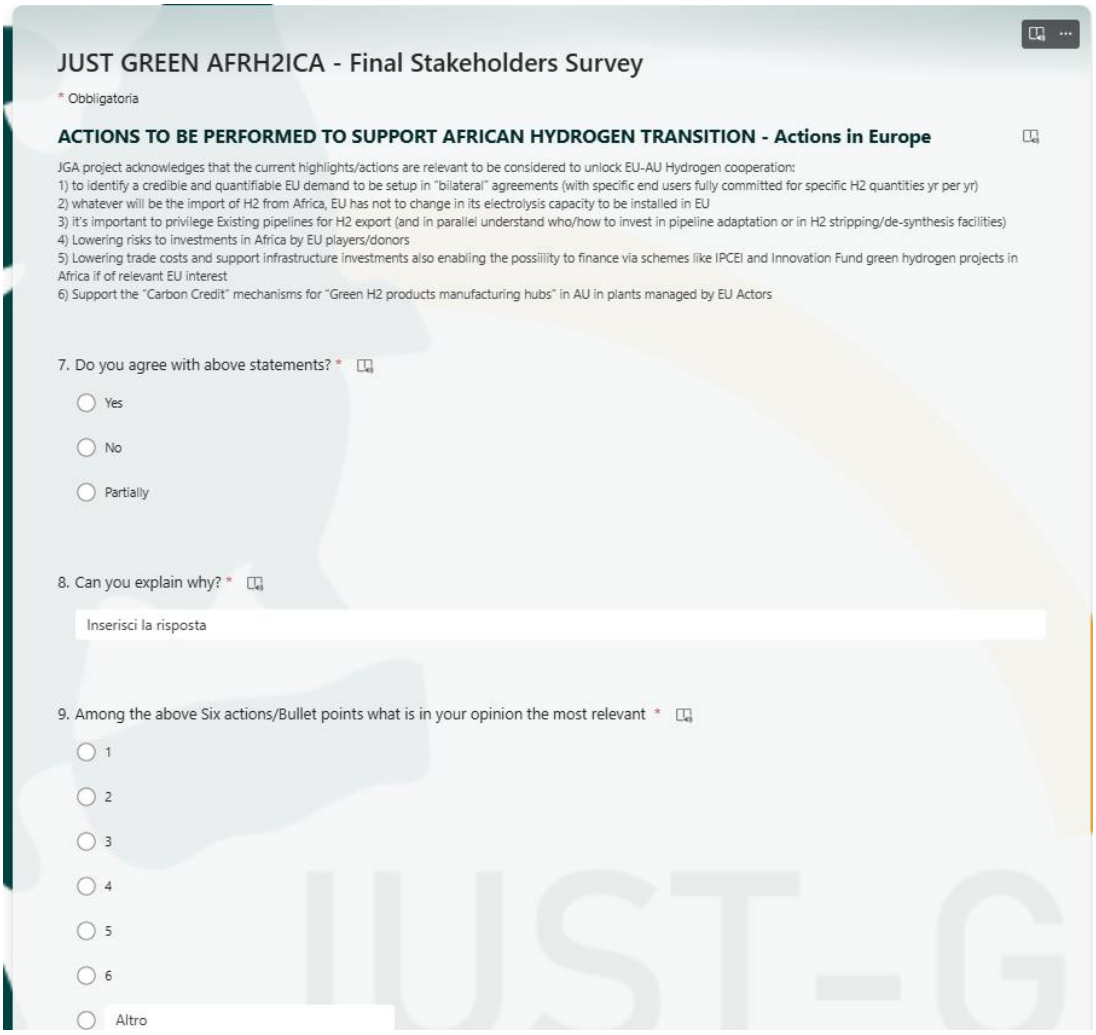

Figure 15 JUST GREEN AFRH2ICA Final Stakeholders online survey – Second Part

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From the outcomes of such survey, UNIGE (also with the inputs of the whole consortium that were collected during the final General Assembly in Rabat in Mid-January) drafted then the10 key actions presented in the following chapter

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3. JUST GREEN AFRH2ICA 10 key actions to promote African JUST Green Hydrogen Transition

A sustainable and equitable green hydrogen economy in Africa requires clear actions to enable the setup not only of green hydrogen production plants, but also of a full value chain from a manufacturing, regulatory, knowledge, investment and R&D point of view.

All these aspects have been studied along the projects and specific key actions, with specific goals towards 2030 (short term) – 2040 (medium term) – 2050 (long term) have been defined looking at initiatives that should be promoted both at African and European level also to ensure African hydrogen needs and socio-economic priorities are met before significant hydrogen exports to the European Union (EU) are authorized.

Such key actions are succinctly presented in the following subchapters always referring to more detailed assessment/analysis presented in other WP2 – WP3 – WP4 project deliverables.

3.1 To push the setup and implementation African Union and National Hydrogen Policies

As reported in D3.2 and as also highlighted by the survey's respondents, setting up an effective (and even binding) hydrogen strategy at African Union level is the key starting point for AU Member States to develop their own hydrogen strategy. As assessed in WP1, the number of African countries having currently published and currently properly implementing a National Hydrogen strategy is too limited.

Drafting precise policies is only the first step for a green hydrogen transition: as reported in D3.2 it is indeed crucial also to encourage the setup of a proper governance and monitoring structure of such plans. In this sense Europe can support (as done for Kenya Green Hydrogen roadmap drafting) in all above mentioned phases, sharing its best practices but also trying to align as much as possible since the beginning EU and AU policies

REFERENCE DELIVERABLES: D1.1 – D1.2 – D1.3 – D3.2

Time Horizon	Main Goals
2030	Setup of a Governance and Monitoring structure at AU level to properly monitor the achievement of the goals declared in the he African Green Hydrogen Strategy and Action Plan[2] - at least 20 countries have their own Green Hydrogen Strategy and at least 10 of them are implementing

[2] https://www.greenbuildingafrica.co.za/african-union-approves-african-green-hydrogen-strategy-and-action-plan/

	them with specific implementative and regulatory framework actions similar to the Moroccan Hydrogen Offer[3]
2040	All AU countries have their own hydrogen strategy – AU Green Hydrogen Strategy and Action plans target to 2050 achieved at 60% at least
2050	AU Green Hydrogen Strategy and Action plans target to 2050 fully achieved – Hydrogen production in Africa is carbon neutral (no emission in any hydrogen production process in Africa)

3.2 To further promote Renewable Energy Production in Africa

To promote green hydrogen production, renewable energy sources (RES) production has to be strongly pushed at continental level as the first "practical step" to its coupling with electrolysers. Toi increase and rapidly ramp up renewable energy production in Africa (in order to fully exploit the huge renewable energy potential of the continent) different actions should be performed at regulatory (e.g. facilitating permitting and land usage for Renewable Energy production) and also social benefit (e.g. supporting African electricity access) level. Specific actions, particularly looking at large scale Renewable projects and capacity building for renewable aspects should be considered to further "couple" the development and scale up of renewable energy and renewable hydrogen in Africa.

REFERENCE DELIVERABLES: D1.2 – D1.3 – D2.2 – D2.3

Time Horizon	Main Goals
2030	300 GW of installed Renewable Power Capacity in Africa – oblige donors and investors promoting RES based plants >20 MW to couple them with at least a 1 MW electrolyser to realize first green hydrogen production lighthouse plants – promote in EU-AU knowledge transfer programmes for RES the topic of green hydrogen and electrolysis
2040	360 GW of installed Renewable Power Capacity in Africa– propose feed-in for RES based plants >20 MW coupling them with at least a 1 MW electrolyser to realize first green hydrogen production lighthouse plants – oblige in EU-AU knowledge transfer programmes for RES the topic of green hydrogen and electrolysis
2050	>500 GW of installed Renewable Power Capacity in Africa

[3] https://www.masen.ma/en/green-hydrogen-moroccan-offer

3.3 To promote the Hydrogen Hub paradigm

JUST GREEN AFRH2ICA truly believes that the proposed Hydrogen Hub concept could be the only way to realize (and quickly scale up and replicate) the first green hydrogen hub production plants, particularly guaranteeing continuous and reliable hydrogen off-taking towards bankable green hydrogen production plants. Furthermore, the Hydrogen Hub approach will enable not only Africa to decarbonize its own industrial production, but also to export "Clean and higher value" products to Europe exploiting the existing logistic value chain and facilitating the export to Europe of the benefits of African Green Hydrogen transition (in an easier way than exporting pure hydrogen).

The promotion of "Hydrogen Hub paradigm", will also enable to promote a "step by step" project portfolio as suggested in D3.2 to make African first hydrogen projects more bankable and more limited in terms of electrolysis installation size, creating some first lighthouse projects proving reliability of Green Hydrogen technologies.

REFERENCE DELIVERABLES: D1.2 – D1.3 – D2.2 – D2.3 – D3.2

Time Horizon	Main Goals
2030	Realization of at least 30 "Lighthouse Hubs"
2040	More than 200 Hydrogen Hubs active in Africa for an overall electrolysis capacity higher than 2 GW – trade facilitation mechanisms (e.g. no VAT) for the export of clean products manufactured thanks to green hydrogen
2050	More than 1000 Hubs active in Africa for an overall electrolysis capacity installed higher than 10 GW

3.4 To support Industrial Manufacturing Value Chain technology transfer to Hydrogen

In order to realize a really sustainable hydrogen transition, setting up a real African FCH Technology value chain is of paramount importance. Before investing in setting up new FCH technologies manufacturing lines (that could be quite CAPEX intensive), it is important to clearly assess which could be existing industrial production sectors (in terms of manufacturing lines and know-how) that could be valorised "transferring" them via a technology transfer approach to Hydrogen and promoting such transition

REFERENCE DELIVERABLES: D2.5 – D3.1

Time Horizon	Main Goals
2030	Mapping of key industrial sectors and manufacturing hubs that could be transferred to Hydrogen Sector also according to the localization of the

	industrial site (proximity of relevant hydrogen hubs and most strategic countries)
2040	Setup of an incentivation scheme for technology transfer of manufacturing value chain
2050	At least one African manufacturing site for all FCH technologies and their BoP in order to guarantee a "100% Made in Africa" hydrogen value chain

3.5 To develop an African hydrogen Skilled workforce

In order to develop a true African value chain, a skilled workforce must be developed in Africa, not only to manufacture and install electrolysers but, first of all, to guarantee a proper management and a suitable/correct permitting and authorization of green hydrogen production plants that should be firstly moved by extra-African investors. To do so it is crucial to act at Academic level also to develop specific R&D skills and laboratories to support such capacity building programme, but also at pre-academic level.

Initially specific "knowledge transfer programmes" must be mobilized also with EU support: then the creation of National knowledge hub for Hydrogen will be the guarantee for supporting the continuous update of an African Hydrogen Skilled workforce.

REFERENCE DELIVERABLES: D3.1 – D3.2 - D4.1

Time Horizon	Main Goals
2030	Promote "Knowledge Transfer" programme from EU to AU at academic and pre-academic level also thanks to relevant institutions such as UNIDO, Global Gateway, GIZ… - Setup of first "Hands on Laboratories" dedicated to hydrogen in Africa (so far only few experiences in Africa are present such as the UPM6 in Morocco or NWU in South Africa) – Promote "technology transfer programmes" in African Universities, transferring researchers and professors skills in hydrogen "sisters sectors" (like O&G, process chemistry etc.) to FCH technologies
2040	Definition of high school/pre-academic educational programmes dedicated to hydrogen in All African Countries also in order to get a sort of "AU Diploma for H2" – Definition in each AU country of a "Centre of Excellence" for Hydrogen technologies and setup of a "R&D Network" (Inspired by Hydrogen Europe Research) in Africa promoting hydrogen R&D at continental level with a mutual benefit cooperation of African delegates
2050	Africa is completely independent in terms of knowhow to continuously update its Hydrogen Workforce

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.3.6 To effectively explore Natural Hydrogen potential

Natural Hydrogen has been identified and exploited for the first time in Africa in Mali, where it has been used to produce electricity since 2012. Different Natural Hydrogen Spots have been identified in Africa and the continent could have therefore a predominant role at global level as pioneer and know-how leader for natural hydrogen exploitation.

Time Horizon	Main Goals
2030	Complete mapping of African Natural Hydrogen potential, identification of most strategic reservoirs, attraction of investments for their exploitation, promotion of specific programmes of knowledge/skills development for their exploitation
2040	Setup of an AU "Natural Hydrogen Strategy" also foreseeing specific rules for Natural Hydrogen reservoirs exploitation (and related authorization and long-term exploitation framework) in order to guarantee the proper "Natural Hydrogen cycle" in the reservoirs
2050	Africa is the Natural Hydrogen leader at global level in terms of production, technology and know how development etc.

3.7 To promote Water Desalination as key water supply asset

The possibility to finance water purification assets for green hydrogen production plants has not to be perceived as a threat/alternative to facilitation of water access in African countries. Actually, Green hydrogen promotion (And its own related investment) has to be considered as an opportunity to facilitate water access particularly looking at RES driven desalination investments and particularly promoting regulatory and permitting frameworks in this sense that impose an over-sizing of water purification systems also for purposes different to electrolysis ones.

REFERENCE DELIVERABLES: D2.1 – D3.2

Time Horizon	Main Goals
2030	Installation of 50 desalination plants in Africa for green hydrogen production – development of specific regulatory and permitting framework that impose desalination/water access purification plants oversizing if coupled to green hydrogen production plants
2040	Installation of more than 200 desalination plants in Africa for green hydrogen production
2050	All African green hydrogen production plants rely on sustainable water access also providing benefit to the local communtities

3.8 To consider Natural Gas Pipeline as the main solution for hydrogen export to Europe

Natural gas pipelines connecting Europe and Africa are an inestimable asset from which to start green hydrogen cooperation between Africa and Europe. IN order to valorize such assets in this sense, a specific roadmap of investment must be realized.

REFERENCE DELIVERABLES: D1.2-D1.3 - D2.4 – D3.2

Time Horizon	Main Goals
2030	Definition of the interventions to be realized in Africa, in Europe and along the pipelines to make existing NG pipelines "Hydrogen Ready" – definition among EU TSOs (and also foreseeing specific EU investments via the CEF framework) of the "Investment plan" (And split of responsibilities) to enable the kick-off of H2 transport via AU-EU NG Pipelines as well as the connection with the EU H2 Backbone.
2040	AU-EU NG pipelines are operating with blending NG/H2 up to 5% in mass exporting more than 5 Mt of green hydrogen to EU
2050	AU-EU NG pipelines are operating with blending NG/H2 up to 20% in mass, exporting more than 15 Mt of green hydrogen to EU

3.9 To facilitate the access by African stakeholders to EU financing instruments

African Green Hydrogen projects have issues in attracting investments for their realization, particularly for aspects related to WACC and risk perceived by investors. At this purpose innovative financing schemes could be identified, but (particularly looking at potential green hydrogen projects developed by EU Investors or for EU H2-Export projects or for manufacturing plants managed by EU actors) facilitating the access of African stakeholder to EU Financing instruments (such as IPCEI and Innovation Fund) currently extensively used by EU FCH stakeholders should be encouraged for a mutual benefit purpose, despite the installation of green hydrogen plants wouldn't occur in EU.

REFERENCE DELIVERABLES: D3.2

Time Horizon	Main Goals
2030	First Innovation Fund and/or CEF project dealing with a green hydrogen production plant in Africa having clear benefits promotion in Europe– More than 10 M€ dedicated from EU to green hydrogen production projects in Africa at yearly basis

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2040	Setup of an IPCEI project targeting repurpose of infrastructure (e..g NG pipelines or shipping) for H2 export from Africa to EU – More than 100 M€ are dedicated from EU to green hydrogen production projects in Africa at yearly basis
2050	Cooperation of the African Hydrogen PPP with EU and global donors to co-fund together on specific financing instruments

3.10 To create an African Public Private Partnership for Hydrogen

In order to overcome from one side the limit of public institutions in Africa to setup specific financing instruments/subsidies for green hydrogen promotion and from the other side the risks perceived from the private sector in investing in African green hydrogen transition, truly and duly inspired by EU Clean Hydrogen Partnership, a new Public Private Partnership for Hydrogen has to be setup in Africa to drive local R&D and green hydrogen production deployment

REFERENCE DELIVERABLES: D3.2

Time Horizon	Main Goals
2030	Creation of the Public and Private Partnership – more than 100 members associated (at least 10 EU related actors associated) – 1st call for proposals for R&D projects launched
2040	More than 350 members associated (at least 30 EU related actors associated) – More than 1 B€ of financing to R&D projects in Africa
2050	More than 500 members associated (at least 50 EU related actors associated) – More than 300 M€ of financing to R&D projects in Africa assigned on yearly basis

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4. Most strategic African countries for Green Hydrogen Transition

According to UNIGE analysis presented in D1.2, performed via a multi-aspects assessment and following up the overall WP1 analysis, the current countries seemed to be most strategic ones where to promote first African Green Hydrogen Production hubs:

UniGe – 2023				UniGe – 2040			
Tier 1	*Tier 2*	*Tier 3*	*Tier 4*	***Tier 1***	*Tier 2*	*Tier 3*	*Tier 4*
Egypt	Ivory	Sierra	Rep.of	**Morocco**	Ghana	R. of	Gabon
Angol	Sudan	South	Gabon	**Egypt**	Nigeria	Ivory	Guinea
Moroc co	Tanzan ia	Ghana	Togo	**South Africa**	Namibia	Zambia	Sierra Leone
Nigeri a	Ugand a	Algeria	Mauritius	**Algeria**	Kenya	Mozambiq ue	Togo
Ethiopi	Zambia	Cameroon	Eq.	**Maurita**	Ethiopia	Sudan	Gambia
Kenya	DRC	Mozambiq	Madagas	**DRC**	Angola	Uganda	Madagas
	Malawi	Senegal	Lesotho		Tanzani	Guinea	Benin
	Namibi	Tunisia	Mauritani		Tunisia	Senegal	Liberia
	Guinea	Zimbabwe	eSwatini		Camero	Malawi	Mauritius
	Ruand		Benin			Mali	Burundi
	Mali		Liberia			Ruanda	Niger
			Libya			Zimbabwe	Burkina
			Botswan			Libya	Guinea-
			Cape			Lesotho	Eritrea
			Burundi			Botswana	Djibouti
			Seychelle				eSwatini
			Burkina				Cape
			Gambia				Seychelle
			Djibouti				S. Tomé &
			Eritrea				Comoros
			Niger				Chad
			S. Tomé &				Somalia
			Somalia				CAR
			CAR				South
			Guinea-				
			Comoros				
			Chad				
			South Sudan				

Figure 16 Multi Aspects Green Hydrogen potential Assessment by UNIGE from D1.2

- Egypt, Angola, Morocco, Nigeria, and Ethiopia are the most strategic countries in the 2023 horizon analysis, with particular attention to Morocco and Tunisia for their direct connection to Southern Europe via gas pipeline

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- Morocco, Algeria, South Africa, Egypt, and Mauritania are the most strategic countries for the 2040-time horizon, considering their significative future renewable installed power capacity
- Morocco, Egypt, Algeria, Kenya, Namibia, South Africa, and Mauritania released hydrogen strategies, while Mauritania (who just released a pre-official policy) and Tunisia strategies are still under development despite this great potential highlighted above.

Following such assessment and also in accordance to other aspects analysed in WP2 and WP3 (e.g. manufacturing value chain and knowledge availability, water supply access...) it is relevant to somehow "close" the above mentioned list to the following countries which have to become (and which are having actually already such role thanks to specific initiatives such as the Moroccan Hydrogen Offer) the frontrunners of African Green Hydrogen transition, being therefore the privileged interlocutors for Europe but also the privileged recipients of JUST GREEN AFRH2ICA project results.

Egypt, Kenya, Mauritania, Morocco, Namibia, Tunisia, and South Africa share several defining characteristics that position them as **frontrunners**: all of them have significant renewable energy potential and access to water resources, either through freshwater in regions without significant water stress or seawater desalination. A key factor distinguishing these countries is the presence of a national hydrogen strategy and at least one planned renewable hydrogen project that has advanced beyond the concept phase to the feasibility study stage or further, signaling a tangible commitment to the sector.

Furthermore, all these countries, could rely on a significant presence of local hard-to-abate industries that can become the first off-takers of locally produced green hydrogen as promoted by JUST GREEN AFRH2ICA hydrogen hub approach and making electrolysis project more easy to be bankable (Also considering the good stability of local economies).

Additionally, all these countries have sea access, which is crucial for potential hydrogen exports as well as for seawater desalination access and they do have or NG Pipelines (.Morocco, Tunisia) or relevant LNG/Port infrastructure (South Africa, Egypt). Mauritania, Namibia and Kenya currently lack terminals for hydrogen derivatives which could limit export opportunities in the short term. Actually Kenya, Tunisia, and Mauritania, face also higher country risk (from a political stability and investment freedom indexes point of view) ratings, which could hinder investment and complicate project execution.

In order to deploy the goals that these frontrunners countries already imagined in their National Hydrogen Strategies, a critical first step is strengthening the legal, regulatory, and institutional frameworks to provide clear and consistent guidelines for project development. Establishing one-stop-shops to streamline approvals and administrative processes will further enhance efficiency and attract investment. Supporting local hydrogen offtake is another priority, with a focus on local hard-to-abate industries like fertilizers, refineries or steel sector (DRI) that are low-hanging fruits. This approach fosters immediate demand, creates local economic value, and contributes to advancing green industrialization.

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Key risks should also be mitigated to encourage investor confidence and project viability. The offtake risk can be addressed through mechanisms like quotas, mandates, and contracts-for-difference, or even the blending with donors/public funding instruments and tools like European project ones. Higher country risk ratings, particularly in countries like Kenya, Tunisia, and Mauritania, require targeted de-risking strategies, including political risk insurance, foreign investment guarantees, and partial credit guarantees. Last but not least, such frontrunners countries have to push on "permitting facilitation" (as done by Morocco with the Green Hydrogen Offer) and "capacity building" setting up short term targets in order to enable a local workforce to be ready to autonomously manage first green hydrogen production plants that would occur in these countries before 2030.

Following these frontrunners, other countries like Algeria, Nigeria, Mozambique, Angola, Ethiopia and Democratic Republic of Congo should be supported and encouraged (not only by EU but also by African frontrunners) to develop their own hydrogen economy in order to valorise their own O&G infrastructures, plants and know how (Algeria, Nigeria, Mozambique - also looking at export capabilities particularly for what it concerns Nigerian ports and Algerian pipelines) and their great RES potential (also promoting green hydrogen transition as a booster of their current critical economies increasing local electrification and water access).

First of all, also according to key actions presented in chapter 3, these countries have to develop their own National Hydrogen strategy and, also thanks to specific targets and regulatory facilitated frameworks, start to promote themselves also in order to attract specific investors.

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CONCLUSION

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Clean Hydrogen Partnership

Africa holds immense promise as a global hub for low-cost renewable hydrogen production, thanks to its exceptional solar irradiation, as well as significant wind and geothermal resources distributed across various regions. These natural endowments position the continent to become a future leader in clean hydrogen, with the potential to transform not only its energy landscape but also its broader socio-economic trajectory.

Green hydrogen represents a transformative opportunity for Africa. It could play a pivotal role in decarbonizing hard-to-abate sectors, enabling green industrialization, stimulating economic diversification, and reducing dependency on volatile global commodity markets. In doing so, it could catalyze job creation, enhance local value chains, and ultimately raise the standard of living for millions of people across the continent.

However, the path to realizing this potential is not without challenges. Globally, the green hydrogen industry is still in its early stages, and most projects face significant barriers—such as high capital costs, uncertain demand due to the lack of committed offtakers, and evolving regulatory environments. Africa faces all these issues, compounded by additional constraints including limited infrastructure, elevated perceived investment risks, and a shortage of skilled labor. Furthermore, large-scale deployment of hydrogen projects must coexist with the urgent need to expand electrification and decarbonize Africa's existing power systems—challenges that are central to the continent's broader energy transition.

Despite global momentum, Africa's share in announced renewable hydrogen capacity remains limited. Of the 49 million tons per annum (Mtpa) of hydrogen project capacity announced globally by 2030, only about one-seventh is planned for Africa. Moreover, as of 2024, just 7% of these projects worldwide have reached a final investment decision (FID) or are under construction—highlighting the uncertain pace of progress and the risk of under-delivery. This is actually even tougher for Africa, where less than 5% of green hydrogen projects currently in African Pipeline achieve an adequate maturity

To harness the full potential of green hydrogen, Africa would benefit from a continent-wide strategic action that must be put in place by African Union, also properly following up (with a dedicated governance) the recently presented African Green Hydrogen Strategy and Action Plan.

In order to facilitate this process, JUST GREEN AFRH2ICA is presenting in this report (that wraps up together with D3.2 all WP3 activities) and integrated strategic roadmap which focused on the importance of:

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Policy and Regulatory Alignment: Developing coherent, investor-friendly regulatory frameworks that provide clarity on licensing, pricing, carbon accounting, and sustainability criteria.

Infrastructure Development: Investing in critical enablers such as renewable energy grids, water desalination, and transport infrastructure (e.g., pipelines, port terminals).

Skill Building and Knowledge Transfer: Creating training programs and knowledge partnerships to develop a skilled workforce for hydrogen production, maintenance, and export logistics.

Attract Investments also via blended Financing Models: Leveraging concessional finance, development funding, and public-private partnerships to reduce perceived risks and attract private capital.

Support African Union "centralized initiatives" and Regional Collaboration: Encouraging cooperation among African nations to create economies of scale, align technical standards, and build shared value chains for hydrogen production, use, and export.

At this purpose, also leveraging inputs collected from EU and AU green hydrogen stakeholders, D3.3 present 10 key actions covering above mentioned macro-topics and setting up specific goals towards 2030-2040-2050 for both African and European stakeholders.

A strategic, coordinated approach could help Africa not only participate in but shape the future global hydrogen economy—positioning the continent as a key supplier of sustainable energy while addressing its own development priorities and the setup of a proper green hydrogen economy, demand and value chain.

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