

Green African Hydrogen Bonds

“Financing the Green African
Hydrogen Deal”



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1. Abstract

African governments and companies participating in the Green African Hydrogen Deal need access to functional, liquid capital markets to raise funding for green hydrogen projects, such as the proposed trans-African hydrogen fuel cell truck and bus routes.

Green bonds are an attractive financing tool for large scale African Hydrogen Partnership (AHP) programmes, providing a low-cost, long-term source of capital. The AHP aims to provide participating members with support to develop efficient, standardized processes for issuing Green African Hydrogen Bonds.

This document provides high-level economic and commercial background information for the anticipated Green African Hydrogen Deal and its trans-African Hydrogen Routes. It explains the rationale and basic characteristics of Green African Hydrogen Bonds. It also discusses how the AHP could help participants develop Green African Hydrogen Bonds in a dedicated green bond market segment for new green hydrogen bonds.



2. Background

The African Hydrogen Partnership (AHP) vision is to implement the first hydrogen economies and societies worldwide in Africa. To realize the hydrogen economies and societies, the AHP aims to provide investors globally with the opportunity to invest in large-scale, lucrative African Hydrogen Programmes. Industry, financial institutions and governments are part of this collaborative approach, also known as Multi Stakeholder Partnership (MSP). AHP seeks to promote and facilitate this approach.

As part of the Green African Hydrogen Deal, African governments will provide the required rules, regulations and incentives for establishing trans-African hydrogen routes between mega-cities, ports and mining centers. Fuel cell trucks and buses refuelling with green hydrogen from P2G/P2H (power-to-gas or power to hydrogen) stations along those major highways will provide participating African nations with large-scale socio-economic and environmental benefits.

The AHP will be a platform for creating mutually beneficial opportunities for governments and financial institutions as well as renewable and hydrogen fuel cell technology and transportation businesses. The AHP will help address capital-raising challenges and with creating a Green African Hydrogen Bond market to finance the trans-African hydrogen routes.

Hydrogen fuel cell technology is the only feasible green technology for green long-haul and heavy goods transportation, due to the high energy density of hydrogen and fast refuelling times. Africa does not have an electricity grid capable of recharging hundreds of thousands of battery-electric trucks and buses on long African highways. Heavy goods and long-haul battery-electric trucks and buses are therefore not economically and commercially viable for Africa.

Studies indicate that demand for only 1,000 hydrogen fuel cell trucks would bring the purchase price down to a similar level to that of traditional fossil fuel trucks. Since operating costs can be equal to fossil fuel trucks - or even lower, especially with low green hydrogen prices - it's reasonable to assume profitable projects can be identified quickly.

It's clear that Africa presents a considerable opportunity, with low-cost renewable energy for the production of green hydrogen available along the hydrogen routes, as well as the importance and size of the heavy goods, long-haul transportation sector.

AHP's goals and strategies are holistic and comprehensive. We believe that supply and demand must evolve simultaneously. They are set to increase,

with the encouragement of an ever-growing number of environmentally friendly global rules and regulations.

By implementing the AHP plan, dependence on US\$ denominated fossil fuel (oil) imports will be reduced significantly and continuously. Domestic hydrogen fuel production will produce great wealth. African national currencies will be strengthened which will cause a lowering of risk for bonds denominated in non-African currencies (such as G10 currencies) and issued by African institutions. There will be a positive impact on foreign exchange rates, with a strong positive socio-economic impact which should strengthen national currencies even further. Along with the approach of spreading risk across numerous countries, issuers and sectors simultaneously as well as continuous provision of a long-term project pipeline, the projected benefits should develop a significant appetite for investing in Green African Hydrogen Bonds.

The implementation of the AHP's strategy, to create multiple trans-African hydrogen routes at the same time, will require heavy investments in infrastructure, industrial production, renewable energy technology and hydrogen fuel cell technology.

The AHP aims to identify and facilitate only economically and commercially feasible projects. Consequently, we support the use of Capital Markets for raising capital. Subsidies are intentionally ignored: instead, the AHP will assist Africa with successfully issuing Green African Hydrogen Bonds, developing a new sector within the green bond market and getting access to capital sources previously out of reach.

Industrial revolutions need large functioning capital markets. The transport sector has enormous potential for issuing green bonds. Issuers require low-cost, long term capital. The AHP aims to support participating issuers with issuing Green African Hydrogen Bonds efficiently and effectively.



3. Green Bonds

3.1. Basics

Green Finance uses financial instruments whose proceeds fund environmental and/or climate change projects. In this context, the term "financial instruments" primarily refers to equity and debt instruments as well as credit and interest rate derivatives.

The Green Bond Principles (GBP) of the ICMA (International Capital Market Association) provide the following definition of green bonds:

"Green Bonds are any type of bond instrument where the proceeds will be exclusively applied to finance or refinance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the GBP"

There are different types of green bonds available. The ICMA's definitions of Standard Green Use of Proceeds Bond, Green Revenue Bond, Green Project Bond, Green Securitised Bond are shown in the Appendix.

In this document we focus on green bonds rather than other green finance instruments, because they:

- provide issuers with access to low-cost long-term capital
- are therefore most suitable for raising high upfront capital
- provide a wider investor base in comparison with other fixed income instruments
- attract new investors
- could be issued internationally if eligibility and market criteria are met
- provide reputational gains and have a positive impact

We favour the green bond market because it:

- has seen astonishing growth since the first bond was issued by the EIB (European Investment Bank) in 2007
- has approximately doubled in size every year since then (see appendix: Q3 2018 Global Market Summary by Green Bonds Initiative)
- has dedicated green bond sections at leading stock exchanges, including
 - London Stock Exchange, UK - the first exchange globally to launch a comprehensive green bond offering with a dedicated segment for these instruments
 - Oslo Stock Exchange, Norway
 - Nasdaq Stockholm in Sweden
 - Shanghai Stock Exchange, China
 - Taipei Stock Exchange, Republic of China (Taiwan)
 - Johannesburg Stock Exchange, South Africa

The green bond market is developing steadily in Africa:

- AfDB (the African Development Bank) has been actively supporting and participating in green bond market development since its early days
- Green bonds have been issued very successfully in Nigeria, Morocco and South Africa
- Johannesburg Stock Exchange has its own Green Bond section
- In Nigeria, FMDQ OTC Securities Exchange, CBI (Convention on Business Integrity) and FSD (Financial Sector Deepening Africa) started a 3-year Green Bond Market Development Programme in 2018

3.2. Rationale

Pricing

- The "green" label can offer pricing advantages for issuers. There have already been very successful, oversubscribed green bond issues: Cape Town municipality's green bond issuance was oversubscribed by 4.3 times and it took only two hours and 29 investors to make required offers
- Investors' appetite is still increasing. Barclays' research indicates that investors are willing to pay a premium of 20 basis points to acquire green bonds ("Investors Are Paying Extra for Environmentally Friendly Bonds, Barclays Says", Tracy Alloway, Bloomberg, 18th September 2015)

Market Access

- Green bonds can attract new investors from outside traditional markets, such as SRI (Socially Responsible Investment) and ESG (Environmental, Social and Governance) investors.
- More and more institutional investors are looking for long-term investments in green projects in emerging markets. Climate change-related investments are in high demand, offering high returns and positive impacts
- An increasing number of bond buyers with minimum thresholds for green investments are looking for new green investment opportunities

Reputational Gains

- Green bonds can enhance the reputation of investors as well as issuers, since they demonstrate commitment to the environment and have a positive impact

Risk Diversification

- Green bond markets have shown stronger resilience to volatility, due to diversified investments and novelty. Investments can reduce the risk for investors and offer more favourable risk-return combinations

Longer Term Stability

- The green bond market provides issuers with access to long-term financing which supports financial stability and continuous growth
- The impact of short-term economic uncertainty may be reduced or avoided

Transparency

- Applying Green Bond Principles helps to provide transparency, accuracy, and integrity of information - especially important for gaining the confidence of more investors to invest in Africa



4. Green African Hydrogen Bonds

4.1. Green Bond Principles and Green African Hydrogen Bonds

Green African Hydrogen Bonds will serve five purposes:

1. Investment
2. Sustainable development
3. African development
4. Fairer international wealth distribution
5. Acceleration of the implementation and deployment of new and essential hydrogen technologies for sustainable development

The proposed Green African Hydrogen Bonds would be a segment of the Green Bond market.

The Green Bond Principles (GBP) have four core components:

1. Use of proceeds
2. Process for project evaluation and selection
3. Management of proceeds
4. Reporting

1. Use of proceeds

The Green Bond market should embrace the creation of Green African Hydrogen Bonds issued for the development of the trans-African Hydrogen Routes.

The 2018 edition of the GBP names a non-exhaustive list of ten eligible green project categories. Any large-scale AHP Hydrogen Route Development programme covers at least six of these most commonly used categories:

1. renewable energy
2. energy efficiency
3. pollution prevention and control
4. clean transportation
5. sustainable water and wastewater management
6. climate change adaptation
7. eco-efficient and/or circular economy adapted products, production technologies and processes
8. green buildings

There is hardly any other investment available that covers so many different green areas simultaneously.

2. Process for project evaluation and selection

AHP members (including financial institutions) will help issuers of Green African Hydrogen Bonds to formulate environmental sustainability objectives. They will also support issuers to define their process for determining how the project fits within the eligible green projects categories and related eligibility criteria.

3. Management of proceeds and

4. Reporting

AHP members (including auditing firms) will support African issuers with developing standard processes and methods for allocating funds, tracking funds and reporting. These high standards will provide transparency, accuracy and integrity of information for all investors.



4.2. Diversification of Risk

An optimized risk diversification should be considered for and applied to every Green African Hydrogen Bond issue.

The following diagrams are constructed examples of an Green African Hydrogen Securitized Bond. They illustrate the holistic, comprehensive and combined approach we advocate: they address supply and demand simultaneously, as well allocating capital to multiple sectors, issuers, and countries in a diversified manner.

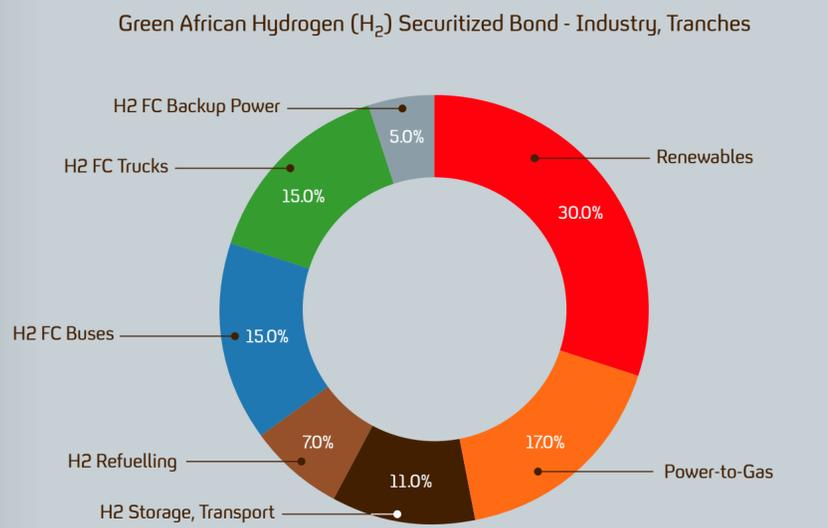


Figure 1: A breakdown of the sample financial instrument by hydrogen fuel cell and related P2G renewable energy sectors required for a functioning green hydrogen transportation and hydrogen fuel production energy system.

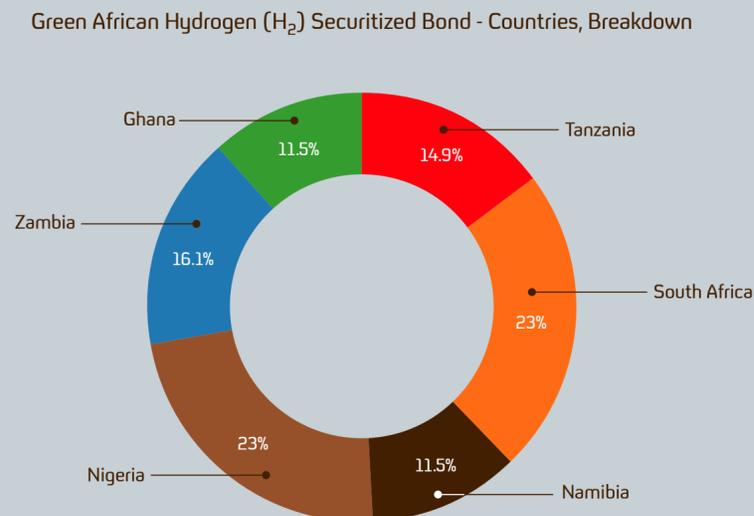


Figure 2: Risk diversification across various countries. The country breakdown of Green African Hydrogen Securitized Bond includes six countries as an illustration: more and other countries could be included too.

5. Developing the Hydrogen Capital Market

Green African Hydrogen Bonds will provide African governments and other issuers with sufficient capital for financing the trans-African Hydrogen Routes which are the core strategies of the Green African Hydrogen Deal.

The Green Bond market has already started to develop in Africa. By creating a Green African Hydrogen Bond segment, the AHP will support participating issuers, from African cities and municipalities to governments and corporates, by:

- Creating a solid and continuous pipeline of large-scale green hydrogen projects and programmes
- Widening investor awareness and participation
- Developing standard Green Hydrogen Bond Principles and standard processes and methods
- Shortening lines of communication between borrowers and lenders
- Assisting to develop innovative green financing to access a wider investor base
- Providing support for issuing international Green African Hydrogen Bonds

6. Concluding Remarks

The sheer size of the AHP programmes required for implementing the trans-African Hydrogen Routes demands access to Capital Markets. The development of the Green African Hydrogen Bond market sector will empower participating African issuers to access necessary capital that was previously out of reach.



7. Appendix

7.1. Green Bond Types - ICMA Definitions

- 1. Standard Green Use of Proceeds Bond**
a standard recourse-to-the-issuer debt obligation aligned with the GBP.
- 2. Green Revenue Bond**
a non-recourse-to-the-issuer debt obligation aligned with the GBP in which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, taxes etc., and whose use of proceeds go to related or unrelated Green Project(s).
- 3. Green Project Bond**
a project bond for a single or multiple Green Project(s) for which the investor has direct exposure to the risk of the project(s) with or without potential recourse to the issuer, and that is aligned with the GBP.
- 4. Green Securitized Bond**
a bond collateralized by one or more specific Green Project(s), including but not limited to covered bonds, Asset Backed Securities (ABS), Mortgage Backed Securities (MBS) and other structures; and aligned with the GBP. The first source of repayment is generally the cash flows of the assets.

7.2. Green Bonds Market Summary, Q3 2018 Update

Highlights of the CBI's Q3 2018 Green Bonds Market Summary:

- USD 29.7bn of issuance*
 - 293 green bond issues with 212 from the USA, 18 from China and 13 from Sweden, 79 issuers from 27 other countries
 - 46 market entrants from 18 countries bring the total number of green bond issuers to 553
 - 52 green bond markets reached, with the first issuer from Uruguay debuting in Q3
 - 4th tap of the Republic of France's sovereign Green OAT, taking the total to EUR 14.8bn (USD 16.7bn)
- (* Data is based on preliminary figures for Q3 2018 issuance volume and number of deals, pending the inclusion of Fannie Mae Green MBS September deals and 32 deals still under assessment for inclusion in the CBI green bond database.)

7.3. Literature

- Alloway, Tracy: "Investors Are Paying Extra for Environmentally Friendly Bonds, Barclays Says"; Bloomberg; 18th September 2015
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- ICMA: "The Green Bond Principles; Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds"; June 2018
- Initiative Climate Bonds: "Green Bonds Market Summary - Q3 2018"; October 2018
- LSE Group, LSEG Africa Advisory Group: "Developing the green bond market in Africa"; Report of Recommendations;
- LSE: "Green and ESG debt financing", Factsheet, website 2019

7.4. Abbreviations

- AHP - African Hydrogen Partnership
- ABS - Asset Backed Securities
- AfDB - African Development Bank
- ASE - African Securities Exchanges Association
- CBI - Climate Bonds Initiative
- EIB - European Investment Bank
- EUR - Euro
- FMDQ - Financial Markets Dealers Quotations
- FSD Africa - Financial Sector Deepening Africa
- JSE - Johannesburg Stock Exchange
- LSE - London Stock Exchange
- LSEG - London Stock Exchange Group
- ESG - Environmental, Social and Governance
- GBP - Green Bond Principles
- MBS - Mortgage Backed Securities
- MSP - Multi Stakeholder Partnership
- OSE - Oslo Stock Exchange
- SRI - Socially Responsible Investment
- ICMA - International Capital Market Association
- P2G - Power to Gas
- P2H - Power to Hydrogen
- SSE - Shanghai Stock Exchange
- USD - US\$

Authors

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Mr. Oldenbroek lives and works in Africa. Mr. Oldenbroek graduated from Delft University of Technology as a Mechanical Engineer, specializing in energy technology. He worked as a project and sales engineer before returning to the University of Technology. His PhD studies researched integrated transport and energy systems based on renewable hydrogen, specializing in microgrids with vehicle-to-grid and hydrogen fuel cell electric vehicles. This study sparked his passion for the unlimited potential of renewables, including battery and hydrogen fuel cell technology. Living in Africa, he has a clear understanding of the large potential of the African continent.

Mr. Huegemann and Mr. Oldenbroek are founding members of the African Hydrogen Partnership.

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