



# THE POWER-TO-**GREEN** HYDROGEN OPPORTUNITY IN EMERGING MARKETS

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# AGENDA: WHY NOW?

Stronger climate regulations

The cost of producing hydrogen from clean sources has fallen dramatically

Hydrogen technologies have improved in cost and performance

The technological infrastructure to support a hydrogen energy system is now available.

*Background image: green hydrogen pilot project to power fuel cell buses by Ad Astra in Costa Rica*



# AGENDA: WHY NOW?

Why  
emerging  
markets?

Applications  
& ecosystem  
for EMs

Near-term  
investment  
opportunities

How to lock  
in  
investments

*Background image: green hydrogen pilot project to power fuel cell buses by Ad Astra in Costa Rica*



# WHY EMERGING MARKETS?



Background image: energy room with electrolyzer and storage by Enapter



# WHY EMERGING MARKETS?

## Ambitious climate & development commitments

- EMs responsible for > 50% of global GHG emissions & growing
- Zero-emission & lower cost solution to replace HFOs
- Local production → job creation & steady supply
- Improve energy security in face of oil price volatility

## Increasing RE investment

- In 2018, EMs built more clean than fossil-fueled power generating capacity:
- 107 GW in new clean energy capacity
- \$133 billion in new investment
- Green hydrogen production has previously occurred in developing countries

## Growing demand

- By 2050, EMs will account for 70% of global power demand
- Decentralized infrastructure ideal for remote locations
- Boost resiliency to extreme weather events
- Take advantage of existing gas infrastructure (MICs)
- Integrate into rapidly growing industrial demand for energy

## Need for versatility

- Multiple applications
- Easy to store, transport, and repurpose (good for island locations, remote communities, polluted urban areas)
- Need for long term storage to integrate VRE into grids. Unreliable grids with insufficient back-up generation capacity and a lack of automated supervisory control and data acquisition systems.

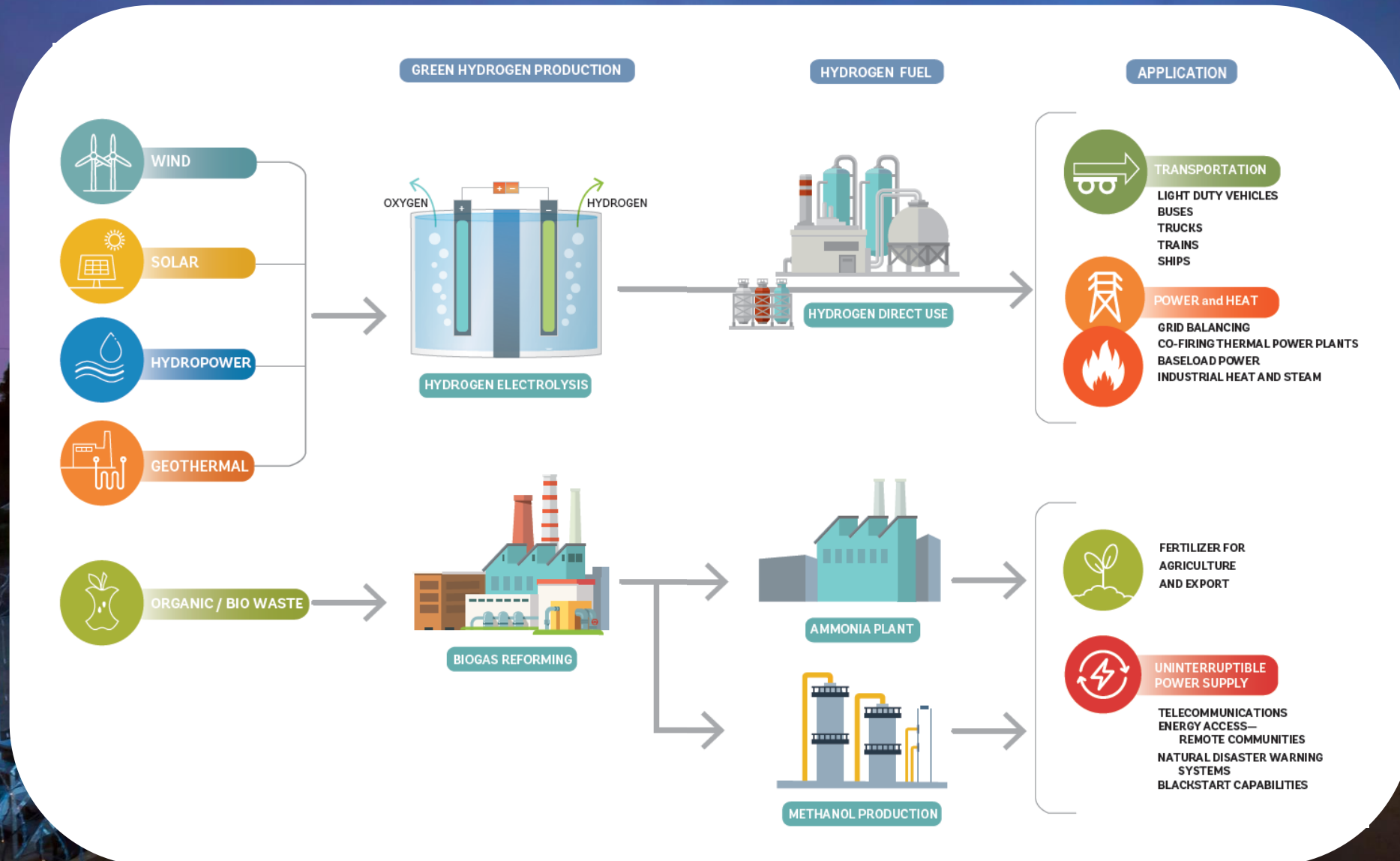
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# PRIMARY HYDROGEN AND FUEL CELL APPLICATIONS & ECOSYSTEM FOR DEVELOPING COUNTRIES





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# NEAR-TERM INVESTMENT OPPORTUNITIES



Background image: off-grid solar and fuel cell system by SFC



# NEAR-TERM INVESTMENT OPPORTUNITIES

## LOCATIONS

1. **Islands and remote communities** that are energy **importers** could use green hydrogen as a **decarbonization** vector across heat, transport, and power.
2. Areas with **excellent renewable resources** or with a **high degree of seasonality** in their renewable power production profiles could consider **green hydrogen as a seasonal energy storage solution**.
3. Middle-income countries with **existing gas infrastructure** have clear **incentives** to explore green hydrogen.
4. **Heavily polluted metropolitan** areas in developing countries could benefit significantly from **fuel cell bus transport solutions**.





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## APPLICATIONS

1. Ammonia-based and methanol-based fuel cell systems for **telecoms** (China, India, Indonesia, Philippines, S. Africa)
2. Small stationary fuel cell systems for **residential and tourism consumers** in Namibia & Thailand
3. Larger hydrogen or fuel cell projects piloted for **stationary power solutions** in Argentina, Mali, Martinique, & Uganda
4. **Mobility**: Fuel cell buses in China, Costa Rica, & Malaysia
5. Hydrogen and fuel cell systems for **forklifts** in material handling in China and South Africa



# HOW TO LOCK IN INVESTMENTS





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## CHALLENGES

- Insufficient scale and track record
- Low levels of technical and safety expertise, including installation & maintenance labor
- Technology remains **capital intensive** with high maintenance requirements
- Perception that deploying new technologies in EMs → **higher risk** than elsewhere
- Investor **lack of awareness** in potential green hydrogen presents for the energy transition





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## SOLUTIONS

1. **Shift the focus to developing countries**, identifying business models that have already been successful (e.g., transport, green minigrids, telecommunication towers).
2. **Develop green hydrogen strategies** to bridge the gap in understanding how green hydrogen fits in our economy and the role it has to play in the future.
3. **Identify opportunities for demand aggregation** with different sectors to exploit economies of scale offered by green hydrogen production equipment, and reduce demand risk.
4. **Foster cooperation to develop regulatory frameworks** that can be shared among countries.
5. **Build capacity** to design, develop and operate green hydrogen projects.



# FLAGSHIP REPORT: GREEN HYDROGEN IN DEVELOPING COUNTRIES

Identifying green hydrogen opportunities and deployment challenges in developing countries

## OUTLINE

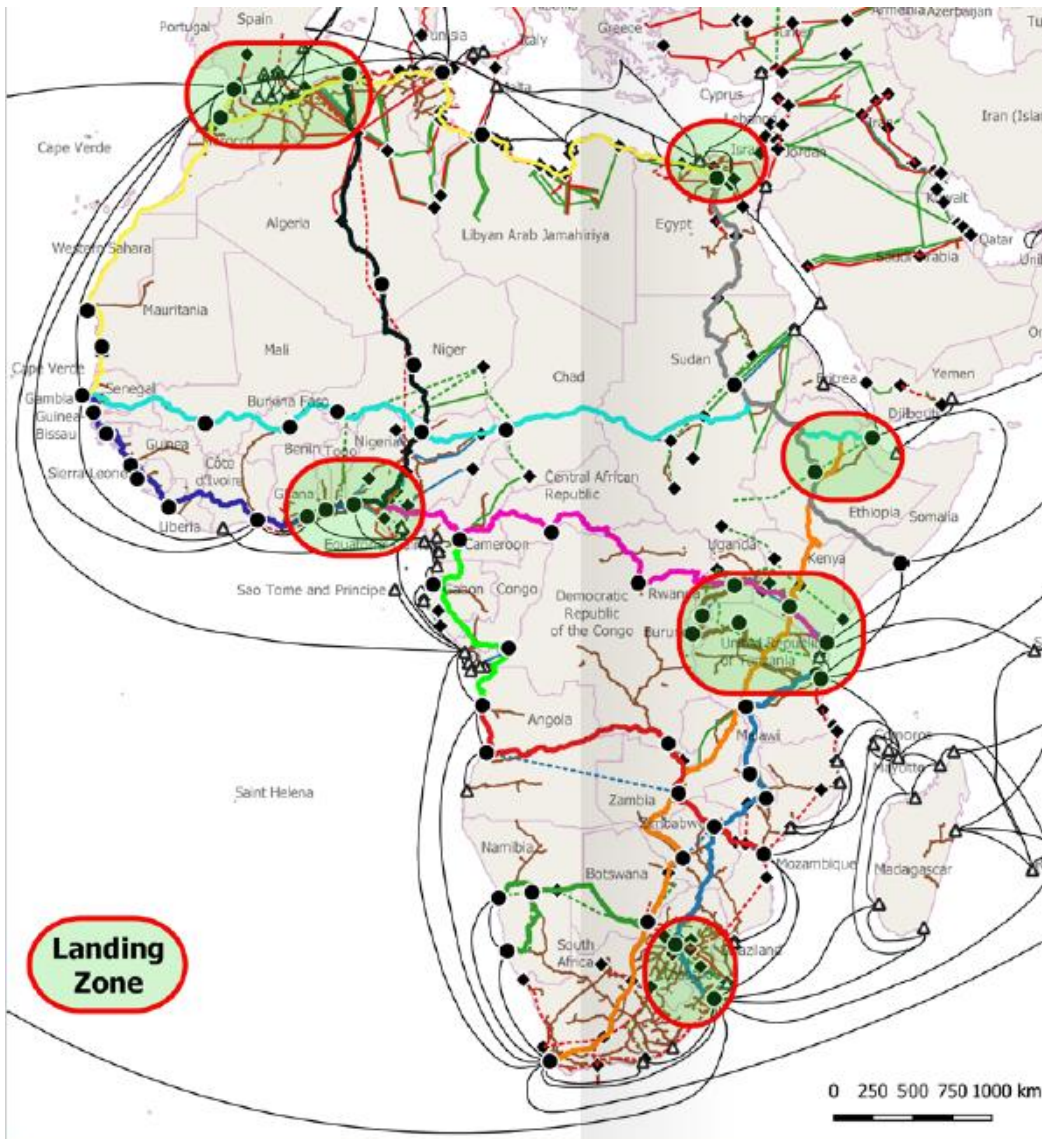
1. Introduction
2. Why hydrogen, why now and why in developing countries?
3. State of the market.
4. Energy applications and commercial solutions.
5. Mobility applications.
6. Industrial applications.
7. Implementation challenges.
8. Areas for further research.

Available at <https://esmap.org/green-hydrogen-in-developing-countries>





# LOOKING TO THE FUTURE: AFRICAN HYDROGEN PARTNERSHIP



Working in partnership with governments, the private sector, and financial institutions, the AHP has drafted a series of strategic documents to help policymakers and investors visualize a pan-African hydrogen strategy.

- Establish landing zones/bridgeheads to develop initial projects
- Expand into other clusters (Djibouti, Egypt, Ethiopia, Ghana, Kenya, Morocco, Nigeria, S. Africa, Tanzania)
- Finance with a green bonds program that works alongside stock exchanges in Africa & Europe to design a framework for investors



# THANK YOU

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