

# SAREP

# Sahara Renaissance Project



H O C H  
S C H U L E  
T R I E R

IfaS



SYNLIFT  
industrial products

# HT Trier - Locations

Trier University  
of Applied Sciences

H O C H  
S C H U L E  
T R I E R

## TRIER – BIRKENFELD – IDAR-OBERSTEIN



**TRIER**  
5,372 Students



**BIRKENFELD**  
2,452 Students



**IDAR-OBERSTEIN**  
50 Students

**HOCHSCHULE TIER**  
8,000 Students  
70 different nations  
160 Professors





# Sustainability Awards of the Environmental Campus in Birkenfeld

- **Fairtrade University 2021**
- **Green Metric Ranking 2022 → ECB – NO 1 in Germany**
  - Nr. 6 Globally and Nr. 1 in Germany (among 1050 universities)
  - Nr. 1 in category „Energy and Climate Protection“
- **International Sustainability Campus Network**
  - World's largest sustainability forum for universities
  - Nr. 1 award in the category „Campus Planning and Management Systems“
- **Nomination German Sustainability Award 2024**
  - UCB was selected from 423 higher education institutions (Federal Statistical Office) in Germany as one of the 10 pioneers of transformation in the category "Schools and Higher Education Institutions".



# Zero Emission Campus – Concept



- **100%** renewable heat supply based on waste wood, biogas (co-generation) and solar thermal
- **100%** renewable electricity based on cogeneration & PV
- **100%** renewable cooling supply based on geothermal, biomass and solar adsorption
- **100%** Energy Efficiency



# One team but plenty of visions...

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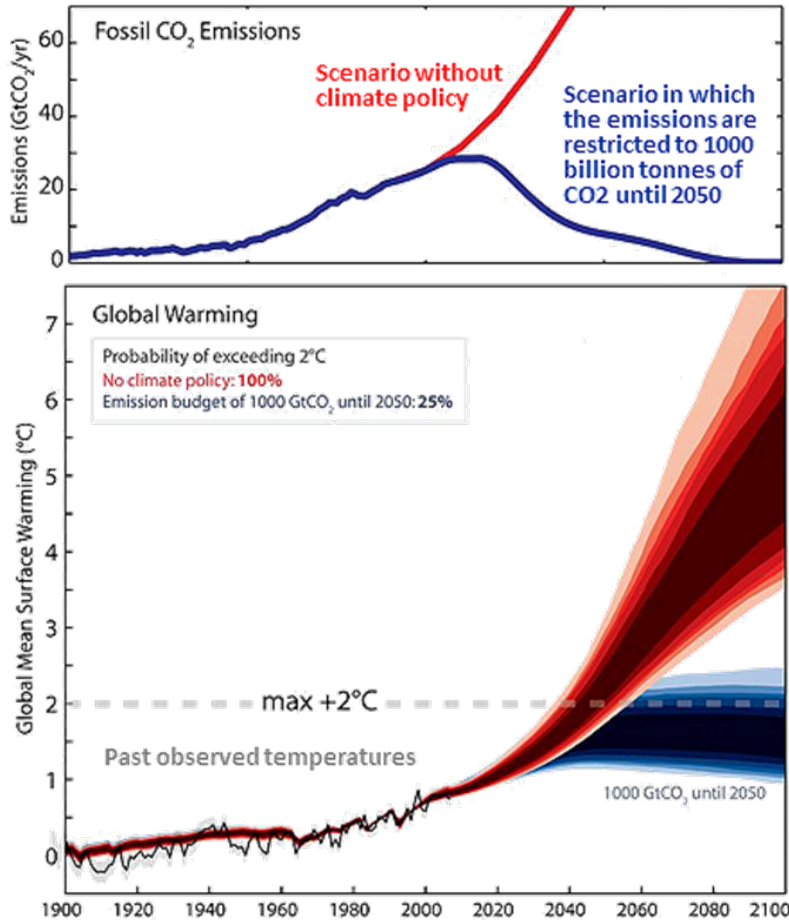


- University of Applied Sciences Trier
- Non-Profit Institute
- 5 Mill Euro turnover/a
- Foundation in 2001
- 9 Professors & 80 Employees
- Interdisciplinary Team
  - Ecological Economics
  - Mechanical & Electrical Engineering
  - Policy Science
  - Spatial Planning
  - Agriculture & Forestry Engineering
  - Environmental Law

# Global Challenges need intelligent answers

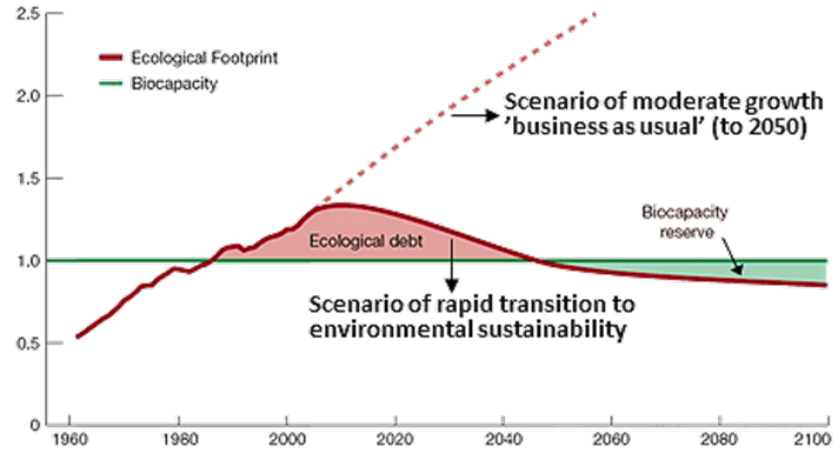
## Global Warming and Carbon Emissions

By scenarios of emissions, in gigatons of CO<sub>2</sub> and temperatures



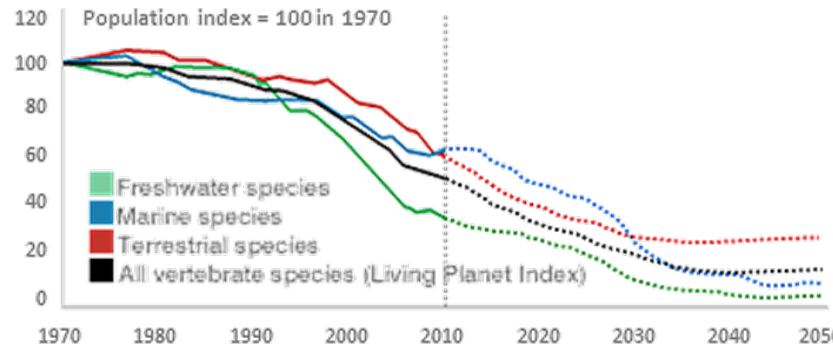
## Global Biocapacity and Ecological Footprint

By scenarios of ecological footprints, in number of Earths needed



## Global Biodiversity and Species Loss

By groups of species, in percentage change in species population



## Global Poverty and Migration Crisis



### Earth Overshoot Day

Tag an dem die menschliche Nachfrage an natürlichen Ressourcen das Angebot und die Kapazität der Erde zur Reproduktion dieser Ressourcen übersteigt



Kreislaufwirtschaft als Schlüssel?! © IfaS

Sources: Institute for Atmospheric and Climate Science (IACETH), World Wide Fund for Nature (WWF), Zoological Society of London (ZSL), United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC), Global Footprint Network (GFN).



# It's the economy – stupid! Those who can do the numbers...

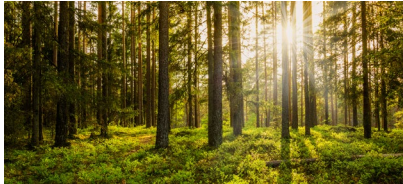


Abb. 19 Wald, Lausitz, Wiedehopf, Moorfrosch

Climate change threatens our

Climate change threatens our

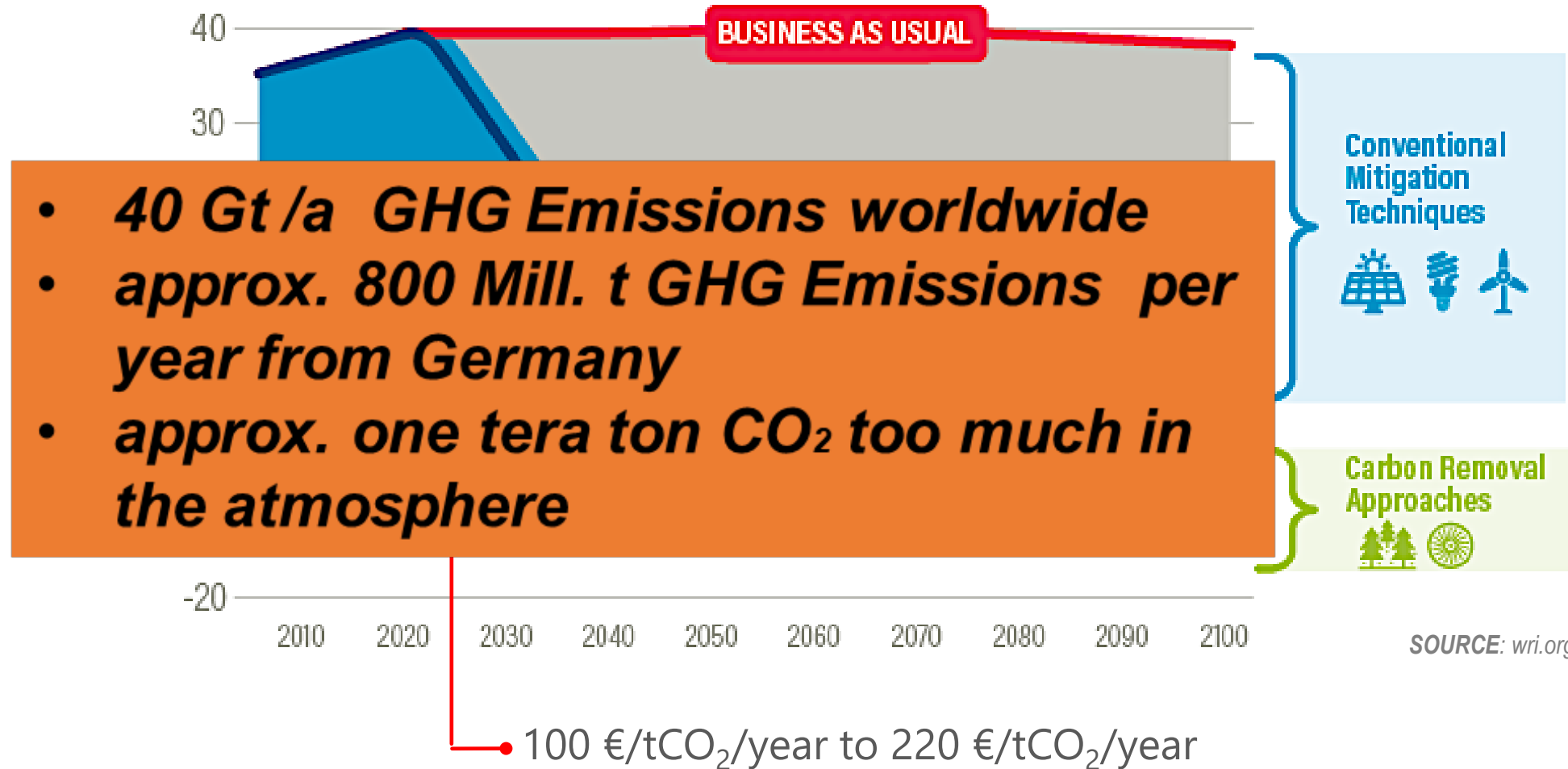
***Sustainability is the better economy***



Abb. 20 Cartoon

Tages-Anzeiger

# The international relevance of carbon removal







- Soil carbon sequestration (SCS) describes methods of soil cultivation which increases the organic carbon content of soil, by capturing atmospheric CO<sub>2</sub>
- Soils contain approx. 2,600 billion tonnes of carbon. This is roughly ***three times more than in the atmosphere***
- Small changes in carbon storage in soil can have a massive impact on CO<sub>2</sub> concentration in the atmosphere

**Desert soils as carbon storage can be a game changer!**

# THIS AREA COULD BE A GREEN CARBON STORAGE AND BIOMASS PRODUCING LAND



- **Storing up to 130 t CO<sub>2</sub>/ha/year**
- **Producing approx. 2,000 litre biofuel/ha/year**
- **Producing up to 80 t dry matter woody biomass/year/ha**
- **Generating 2,000 jobs per 10,000 ha**





المملكة المغربية



# Plantation experimental de Jatropha Curcas

## Exploitation durable des eaux usees dans le Foug E[ Oued pour la culture de biocarburant et la lutte contre la desertification

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# Example: *Jatropha curcas* | High yield through irrigation



[https://www.exot-nutz-zier.de/images/prod\\_images/Jatropha\\_curcas2.jpg](https://www.exot-nutz-zier.de/images/prod_images/Jatropha_curcas2.jpg)  
Prof. Klaus Becker, Universität Hohenheim

**Up to 6t of nuts per ha = up to 2,000 liter of oil and 4t of presscake**

**Plus carbon removal potential of approx. 25 t CO<sub>2</sub>/ha/year**

**10,000 ha yield**



- 20,000 t oil/year
- 250,000 t CO<sub>2</sub>/year
- 20,000 t protein /year
- 6,000 t biochar/year





# Jatropha Loppings to produce biochar



Item	Value	Unit
Absorption capacity	25	tCO <sub>2</sub> /ha/a
Above soil biomass (ASB)	80%	
Below soil biomass	20%	
Pruning ASB	40%	
Biomass dry matter	4.4	t <sub>DM</sub> /ha/a
Charring efficiency	33%	
Biochar (BC)	1.4	t <sub>BC</sub> /ha/a
C-fix content	80%	
BC Sequestration potential	4.2	tCO <sub>2</sub> /ha/a







*Mimosa - 8 Month*

*Jatropha - 2,5 Years*



# Solution Overview | Greening the Desert



## Plant Growth



Desalinated Seawater  
(Use of renewable energies)  
Drip Irrigation/Fertigation



Nutrients (N, P, K)

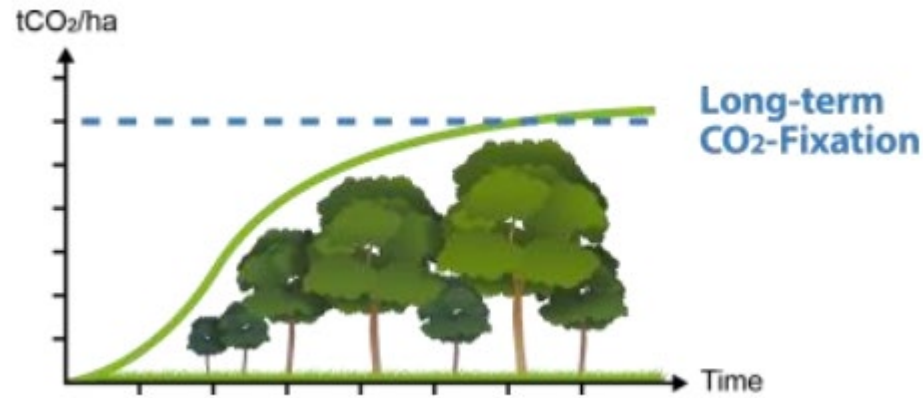


Carbon sequestration

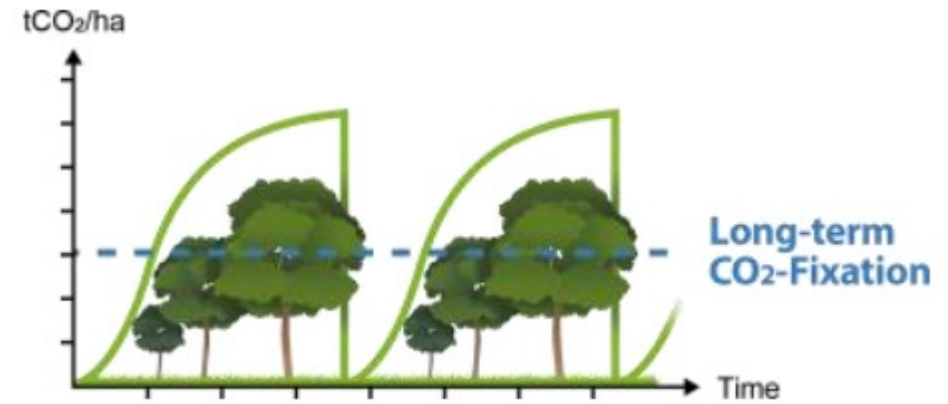


Biomass (biofuel, plant oil, feed and food, timber, wood pellets)

## Conservation Forest or Selective Logging



## Rotation Forestry



$$CFMU, \text{long\_term} = \frac{\sum_{t=1}^T CFMU, t}{T}$$

CFMU, long-term = [tCO<sub>2</sub>/ha] Long-term CO<sub>2</sub>-fixation of a MU

CFMU, t = [tCO<sub>2</sub>/ha] CO<sub>2</sub>-fixation of a MU in year t

T = [ ] Number of years between the planting start and the end of the crediting period

T = 1, 2, 3, ... Years

Logging wood for pellet production falls under rotation forestry





### Carbon certificate price

- 100 €/t

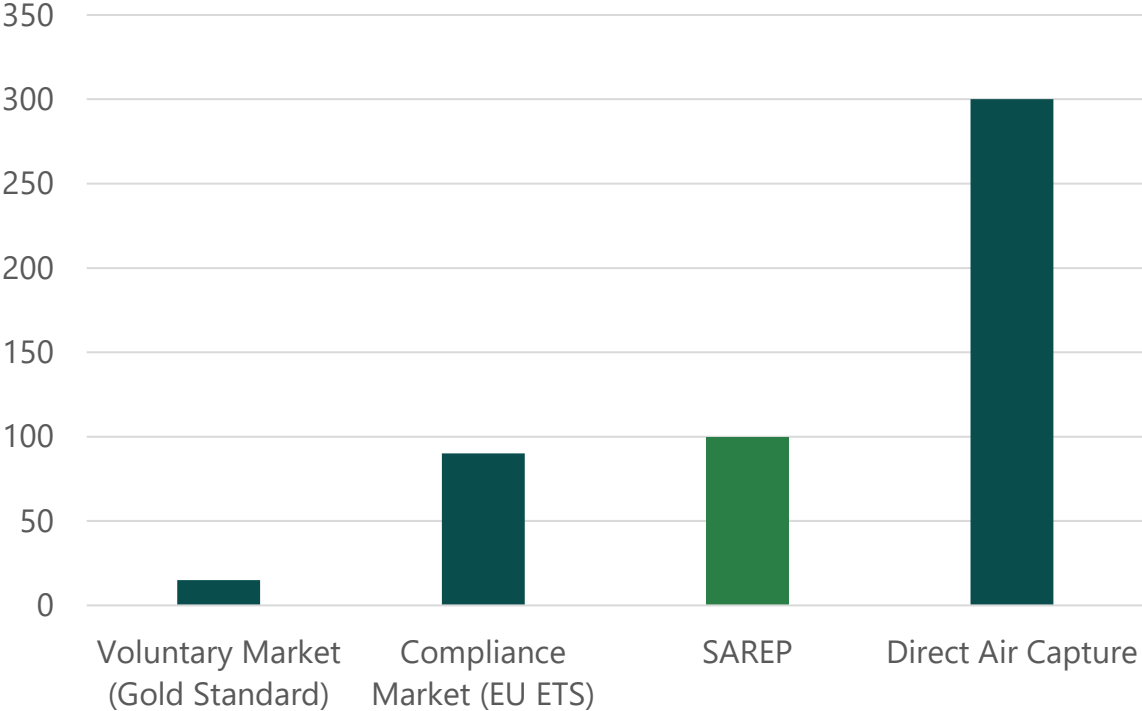
### WACC

- 2%

### Accrediting period

- 30 years

### Carbon Offset Price (€/t CO<sub>2</sub>) 2023



## 650 ha Agroforestry | 60 Mill. € Investment



### Key Facts

- 20,000 m<sup>3</sup>/d Desalination capacity
- 450 ha Prosopis
- 150 ha Jatropha curcas / Moringa oleifera
- 50 ha Staple food
- Application of approved technologies that are available on the market!



## Simplified Overview

**CAPEX: 60,000,000€**

**OPEX: 3,500,000€**

- *Workers: 500,000€*
- *Technical OPEX: 1,800,000€*
- *Interest: 1,200,000€*

**Revenues: 6,375,000€**

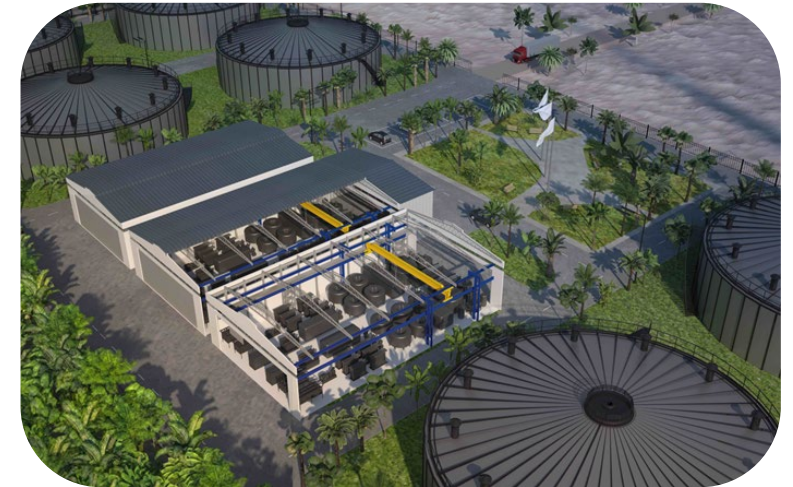
- *Carbon certificates trees: 5,400,000€*
- *Carbon certificates Jatropha: 375,000€*
- *Vegetable oil, food crops: 600,000€*

**KPIs:**

NPV: 11,947,104€

IRR: 2.8%

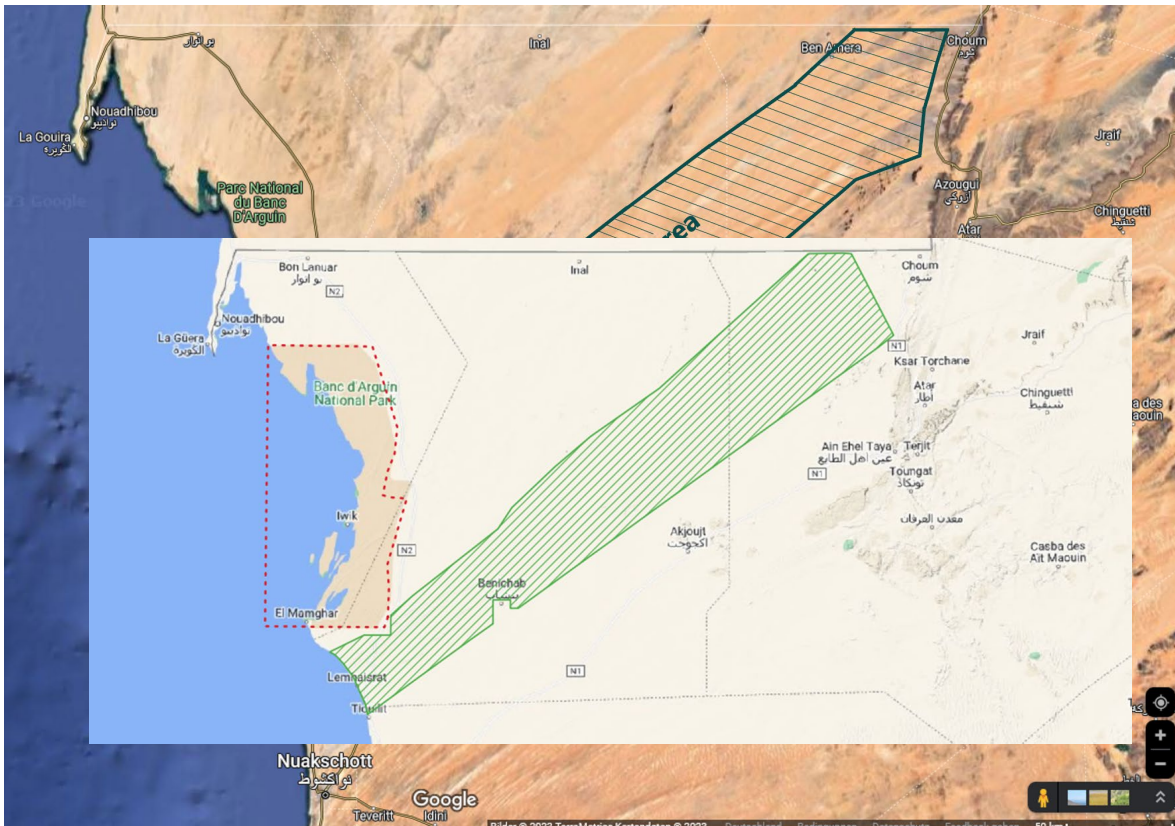
PBP: 18 years



**Nota bene:** In the first three years, revenues could only be made by certifying sequestration during growth phase or by trading carbon sequestration futures.

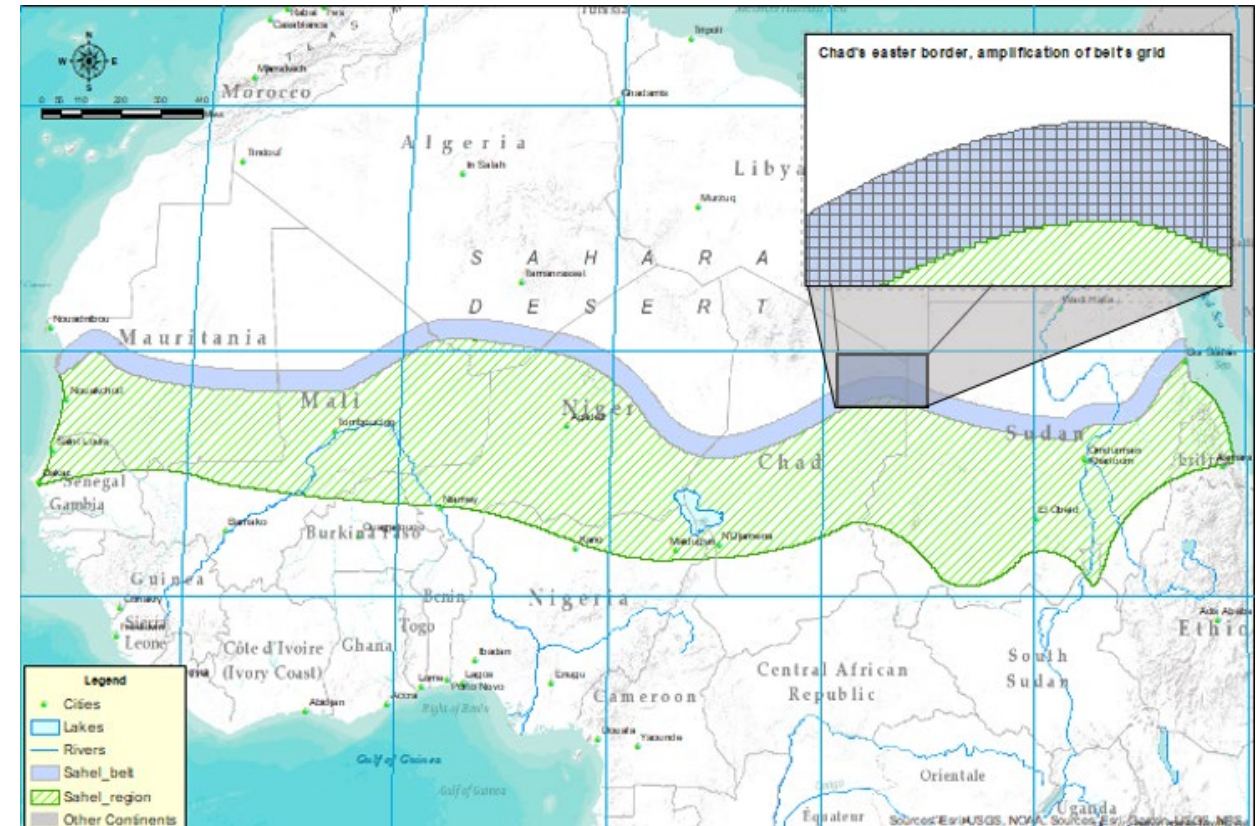
## Initial Area

Coast of Mauritania (2,000,000 ha)



## Long-Term Vision

Mauritania – Mali – Algeria – Niger – Chad -Sudan





## Initial Area

Test plot 650 ha

Capacity Land [ha]	650
Capacity Water [m <sup>3</sup> /d]	20,000
Reverse Osmosis [€]	35,000,000
Energy [€]	10,000,000
Back-up (off-grid) [€]	5,000,000
Agriculture & Infrastructure [€]	4,225,000
Development Capital [€]	5,775,000
Total Capital Demand [€]	60,000,000
LCoW [€/m <sup>3</sup> ]	0.7-0.8
IRR [%]	2.8
PBP [a]	18.1
NPV [€]	12,000,000

## Long-Term Vision

1<sup>st</sup> stage of expansion 65,000 ha

Capacity Land [ha]	65,000
Capacity Water [m <sup>3</sup> /d]	2,000,000
Reverse Osmosis [€]	1,750,000,000
Energy [€]	500,000,000
Back-up (off-grid) [€]	250,000,000
Agriculture & Infrastructure [€]	422,500,000
Development Capital [€]	
Total Capital Demand [€]	2,922,500,000
LCoW [€/m <sup>3</sup> ]	0.3-0.4
IRR [%]	11.9
PBP [a]	3.3
NPV [€]	2,270,000,000

# Objectives

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## Green Business Opportunities

- Mobilizing Private Investments
- Offering a Competitive Product Portfolio

## Climate Change Mitigation & Adaptation

- Initiating Large-Scale Carbon Sequestration
- Industry-Scale Biomass Production
- Industry Scale Hydrogen for local use and export

## Regional Development

- Enhancing Food, Water, Energy Security
- Creating Jobs and Life Perspectives
- Migration Mitigation

## Biomass products for industry

- Biofuel, Pellets, Timber, Protein, Biochar, Cash crops





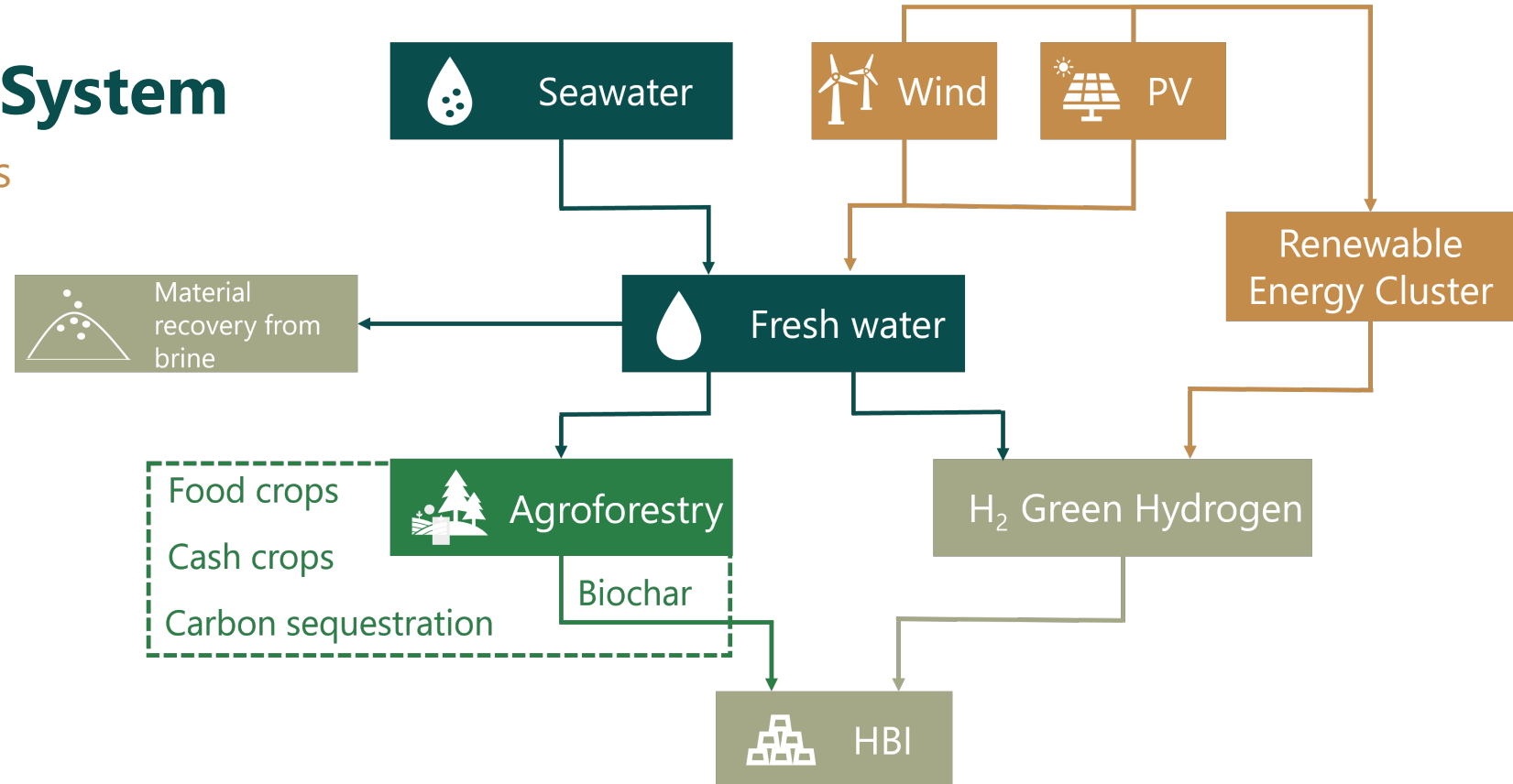
## Food security and regional development through carbon removal, climate mitigation and adaptation



- Store carbon in soil
- Provide jobs and education to African society
- Organize food self-sufficiency for Africa
- Produce green Hydrogen for local use and export
- Produce green electricity and fuels for domestic consumption
- Offer technology opportunities and added value to the African continent
- Provide non fossil carbon for material use
- Provide plant oil substituting diesel and heavy fuel oil

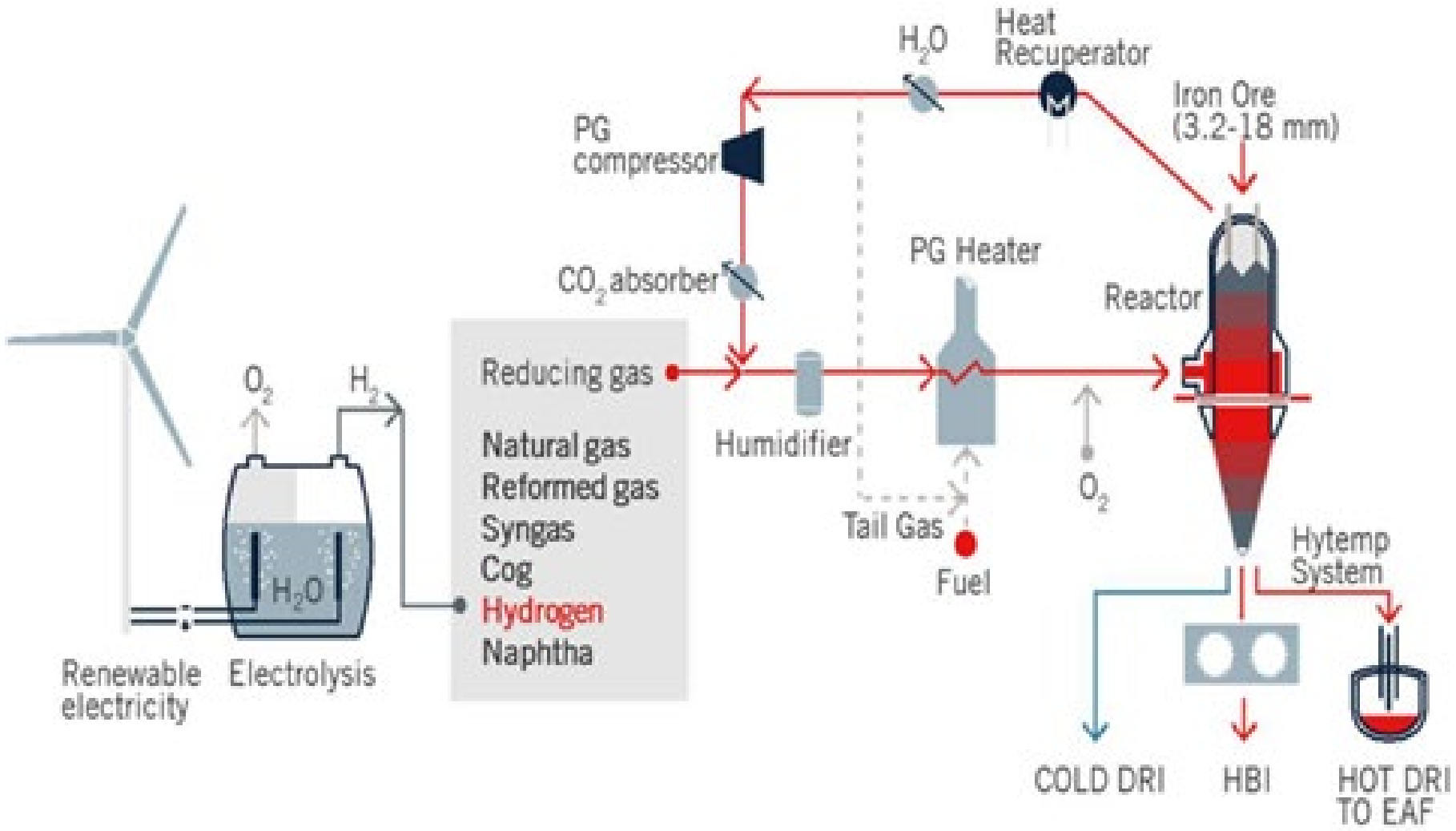
## Production System

Unfolding Synergies

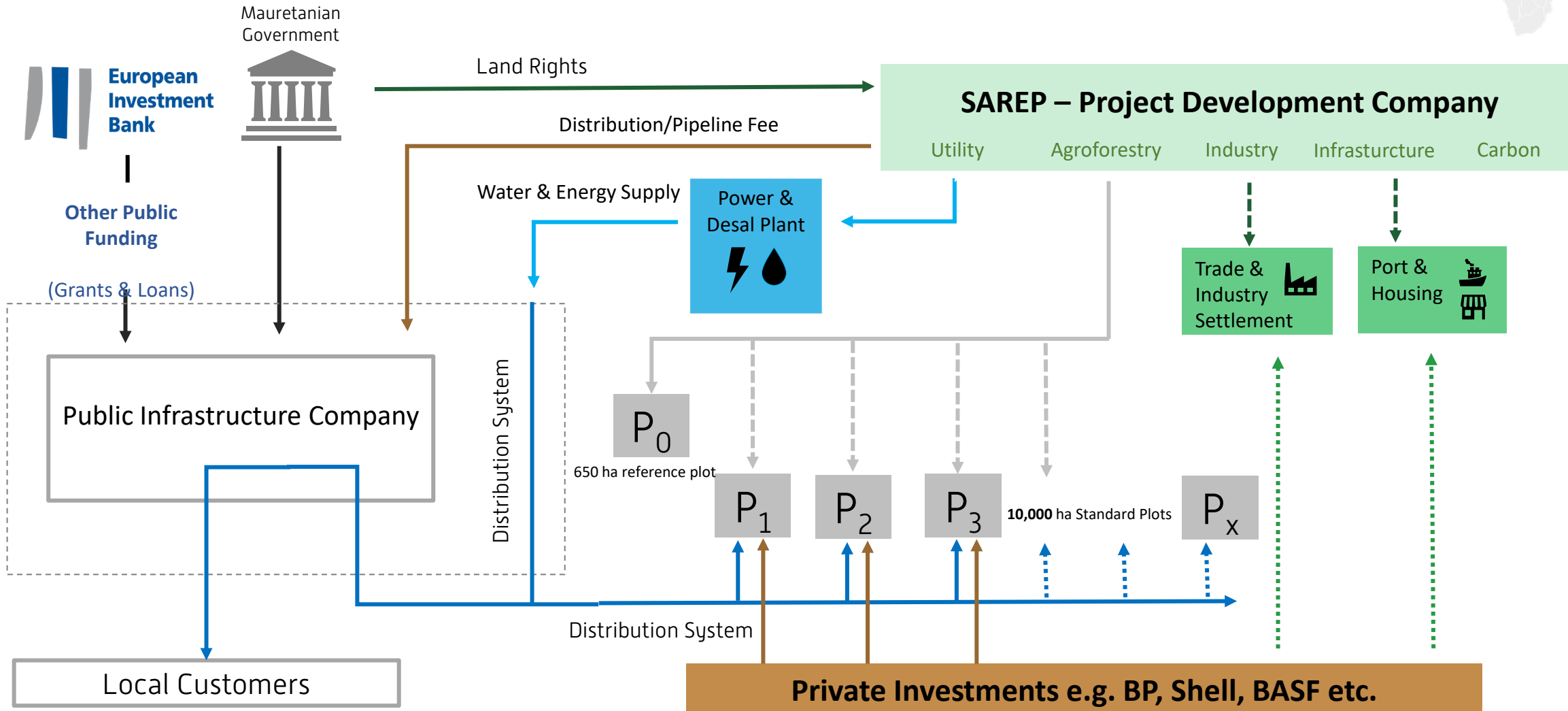




# Hydrogen for **local** HBI: exporting pre-processed iron ore



# Proposed Stakeholder Structure





# Timeline



**2023**

## SAREP Conference

**Objective:** Get-together of Political leaders, decision makers, experts from academia and experienced professionals

**Outcome:** Memorandum of Understanding to form the SAREP Development Initiative



**2024**

## Test Plot Development

**Objective:** Demonstration of the project's feasibility, finetuning of the system

**Outcome:** Increasing the network of potential investors and customers



**2025**

## Scale-Up

**Objective:** Development of 200 10,000 ha plots, realizing economies of scale

**Outcome:** Fully unfolded project impacts and benefits

## Core Team

**Prof. Dr. Peter Heck**

Project Lead, Managing Director of IfaS

**Dr. Gerhard Ohlde**

Agroforestry Expert, Project Manager, IfaS

**Dipl.-Ing. Joachim Käufler**

Seawater Desalination Expert,  
CEO, Synlift Industrial Products GmbH & Co. KG

**Dipl.-Ing. Thomas Neu**

Mining & Steel Production Expert,  
proG.E.O. Ingenieursgesellschaft mbH

**Mohamed Abdoullah Ebnou**

On-Site Project Implementation,  
Engineering and Global Consulting, Mauritania

## Partners from Industry and Academia



**Johan Tijms**

Drip Irrigation System Expert,  
Tijms Trading International BV



**Altinus Klaassen**

Agriculture Machinery Trading and Project  
Development, Attrotrading Africa BV



**George Francis**

Jatropha Expert, CEO, Jatropower AG



**UNIVERSITÄT  
HOHENHEIM**

**Dr. Klaus Becker**

Jatropha Expert, Hohenheim University

- SAREP uses state of the art technologies to solve pressing worldwide problems
- Solar and Wind powered desalinization creates **infinite** water resources at affordable costs
- The water – land – solar energy **nexus** creates carbon storage and green carbon production potentials in industrial dimensions
- SAREP offers large scale opportunities to produce „**sustainable**“ **steel** for local use (HBI) or export
- SAREP offers a sustainable economic and social potential for **local people and migrating refugees**

## **Green Business Model for Carbon Storage, Poverty Alleviation, GHG neutral Steel Production and Food Security**



## IfaS

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Thank you for your time and attention!

