SAREP

Sahara Renaissance Project

Regional added value, new resources and efficient climate protection through desert greening

Prof. Dr. Peter Heck
CEO SAREP, CEO IfaS

2025

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SYNLIFT
industrial products

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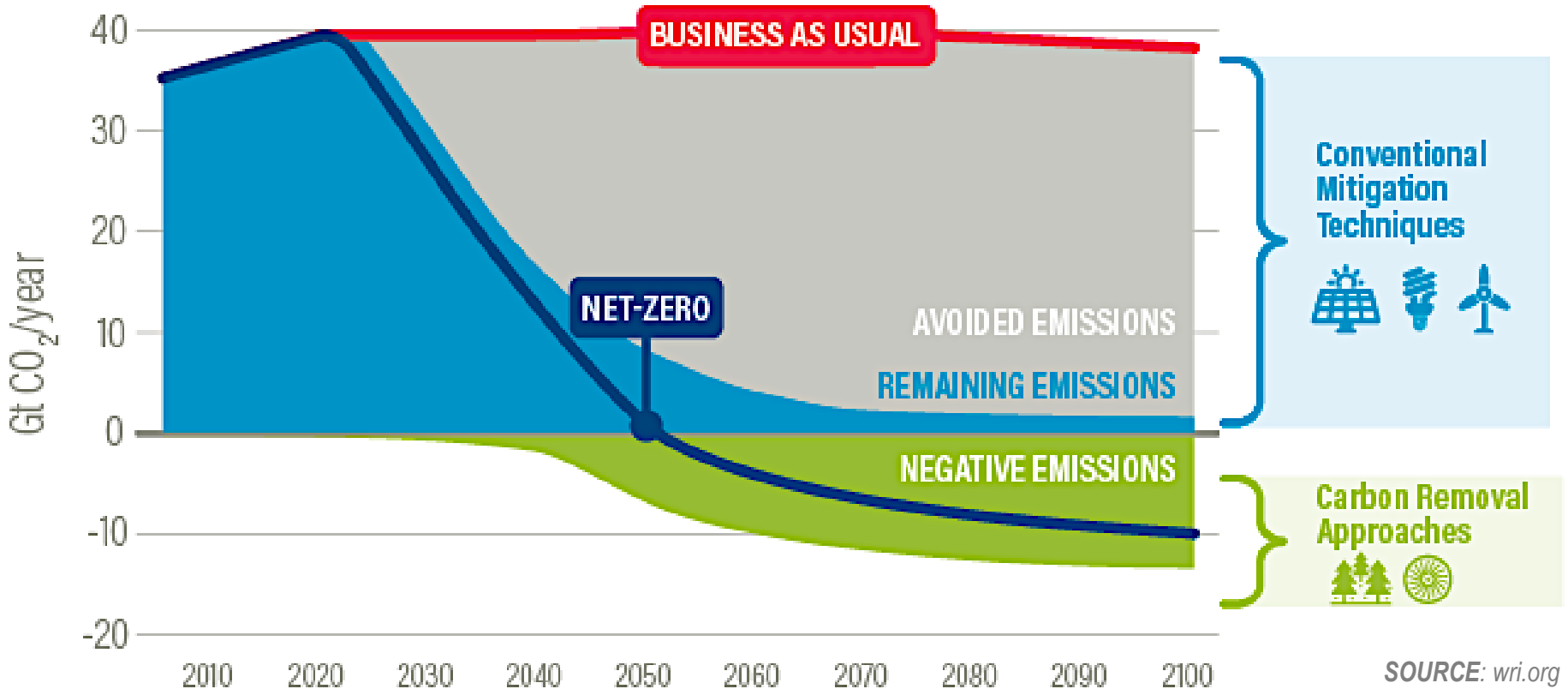
The international relevance of Carbon removal



***SOURCE**: wri.org*

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Global Challenges: insufficient policy but room for private investment

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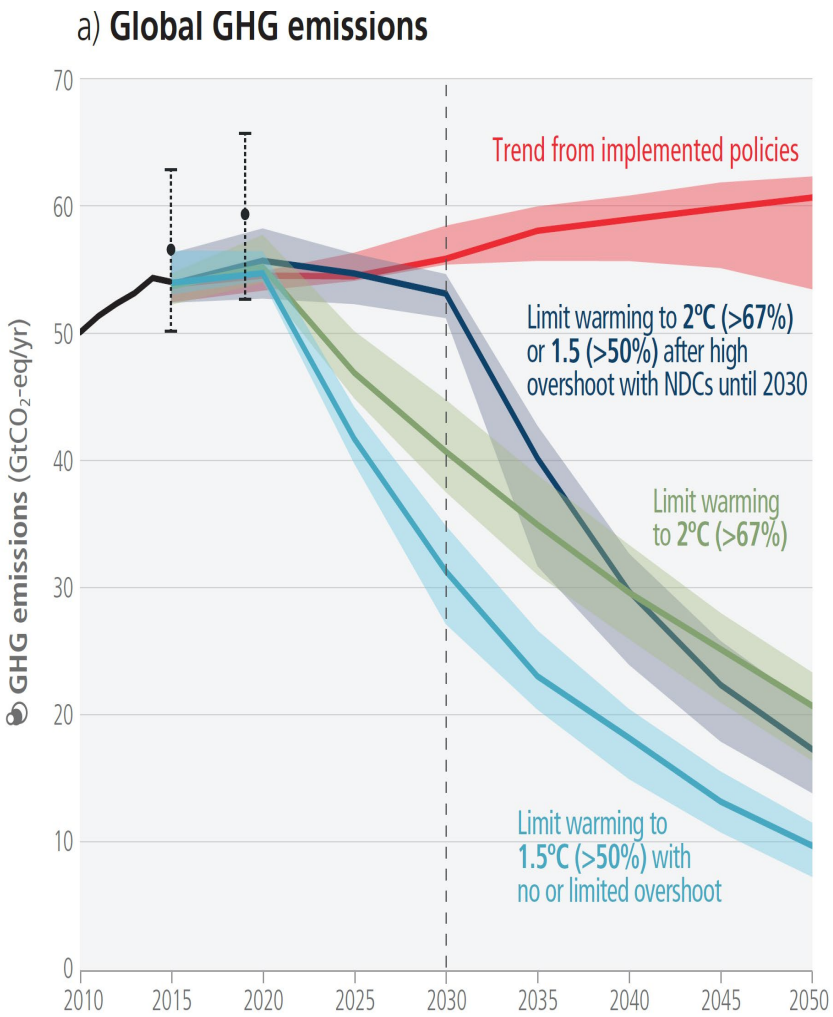
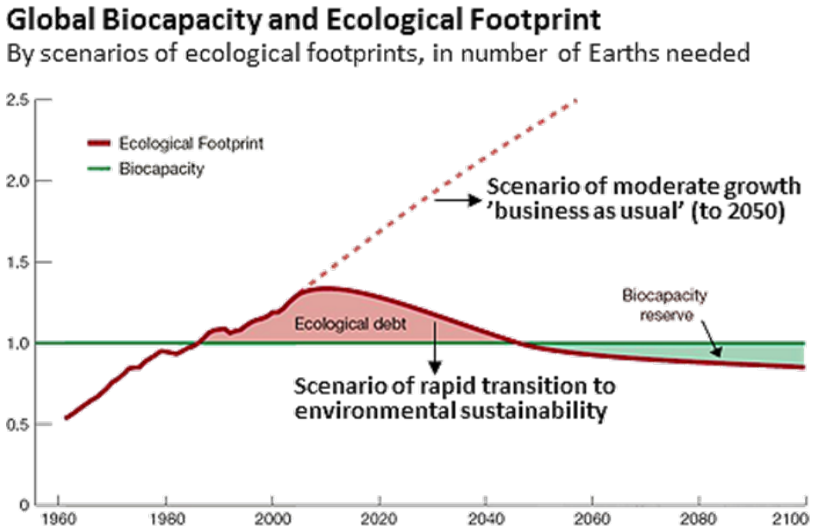
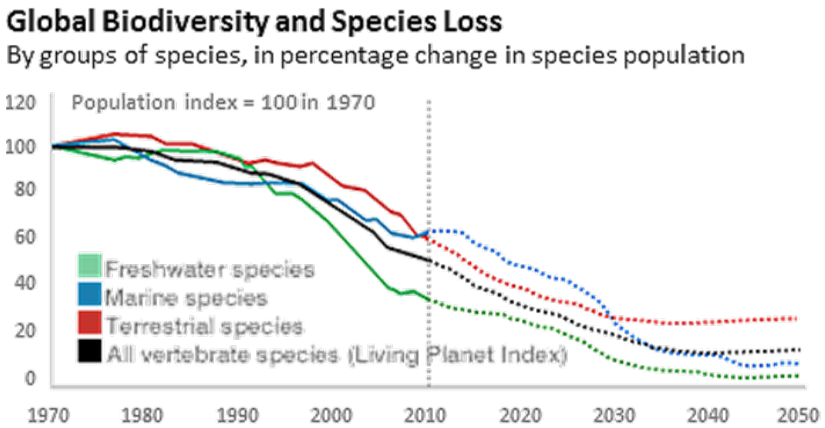


IPCC, 2023





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).

Global Poverty and Migration Crisis

- Trade GHG emissions
- Merge biodiversity & ecotourism
- Supply biogenic materials

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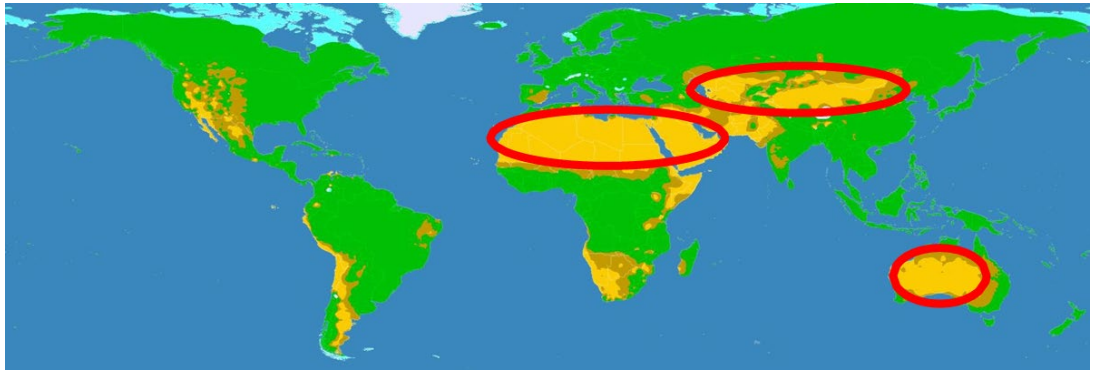
Carbon sequestration in soil



- Soil carbon sequestration (SCS) describes methods of soil cultivation which increases the organic carbon content of soil, by capturing atmospheric CO_2
- 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_2 concentration in the atmosphere

Desert soils as carbon storage can be a game changer!

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

- **Storing up to 160 t CO_2/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**

Solution Overview | Greening the Desert

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Input

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

Nutrients (N, P, K)

Plant Growth

Output

Carbon sequestration

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

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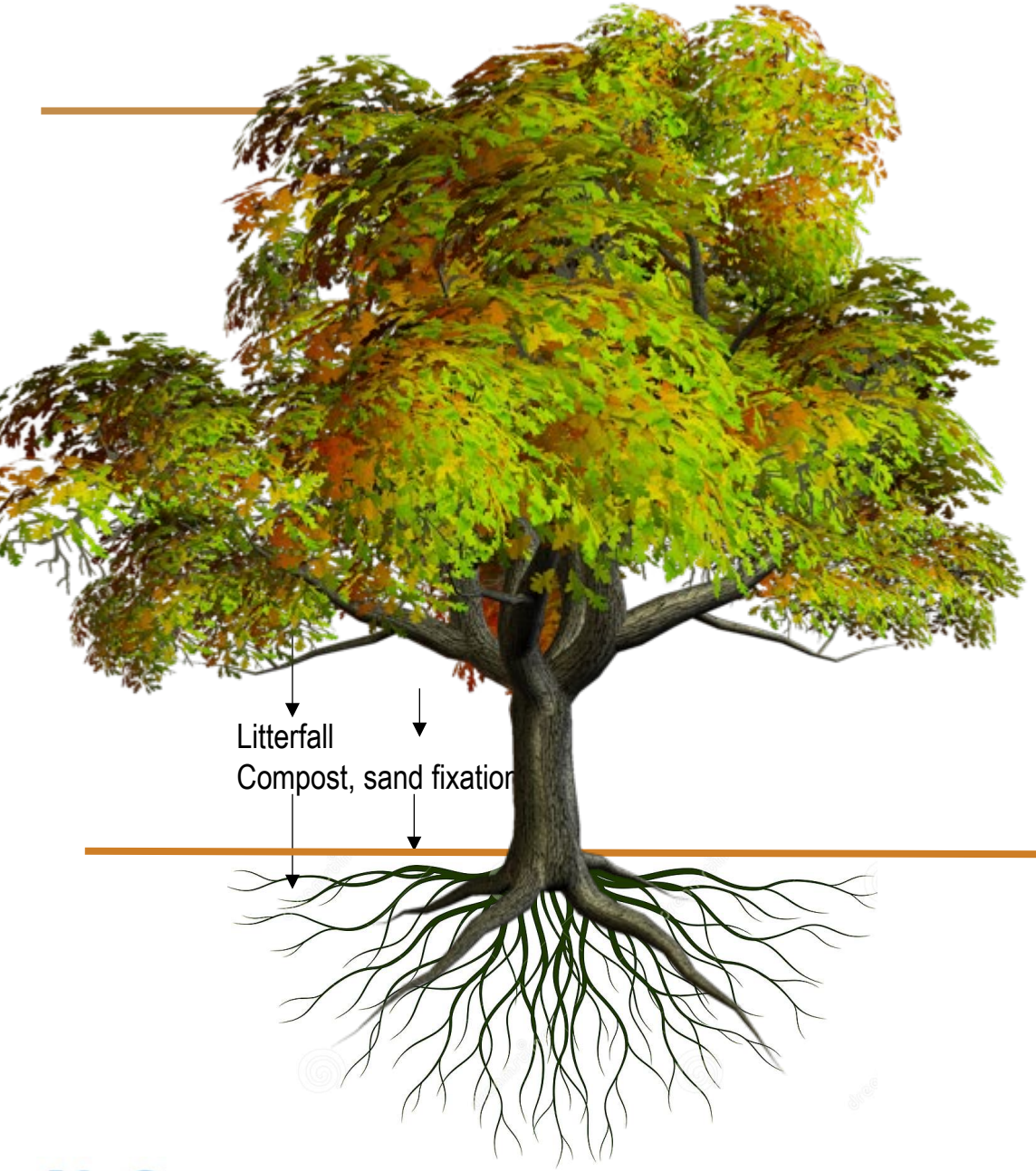
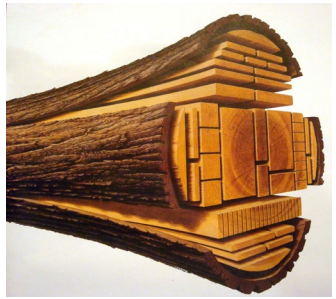


DM

75 %

60 % timber



40 % slabs, crown, branches, bark

charcoal

Soil fertility

25 %

Longterm C-sink

SOC

Biocoenosis
Organic life
around charcoal

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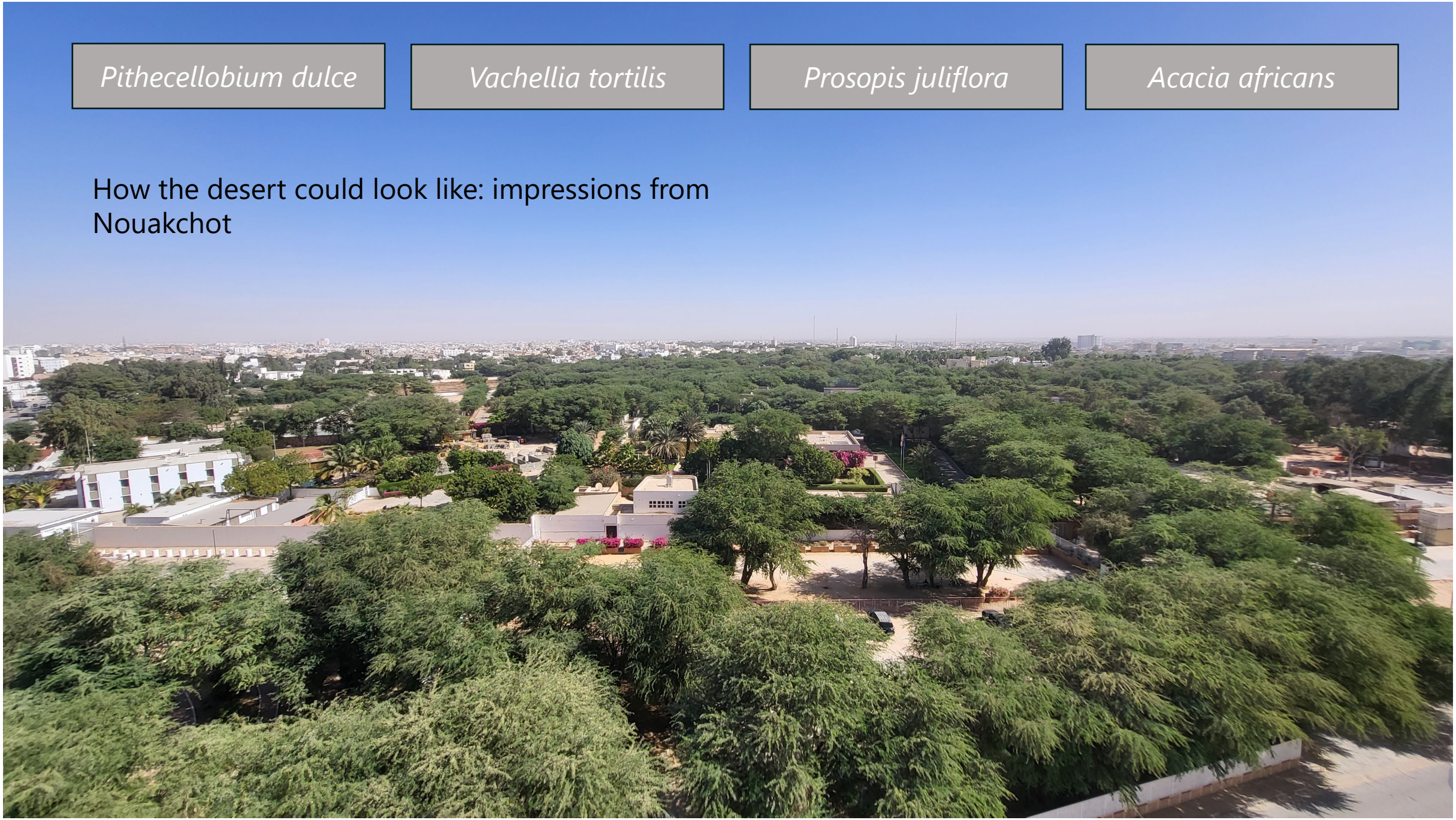
Pithecellobium dulce | *Vachellia tortilis* | *Prosopis juliflora* | *Acacia africans*

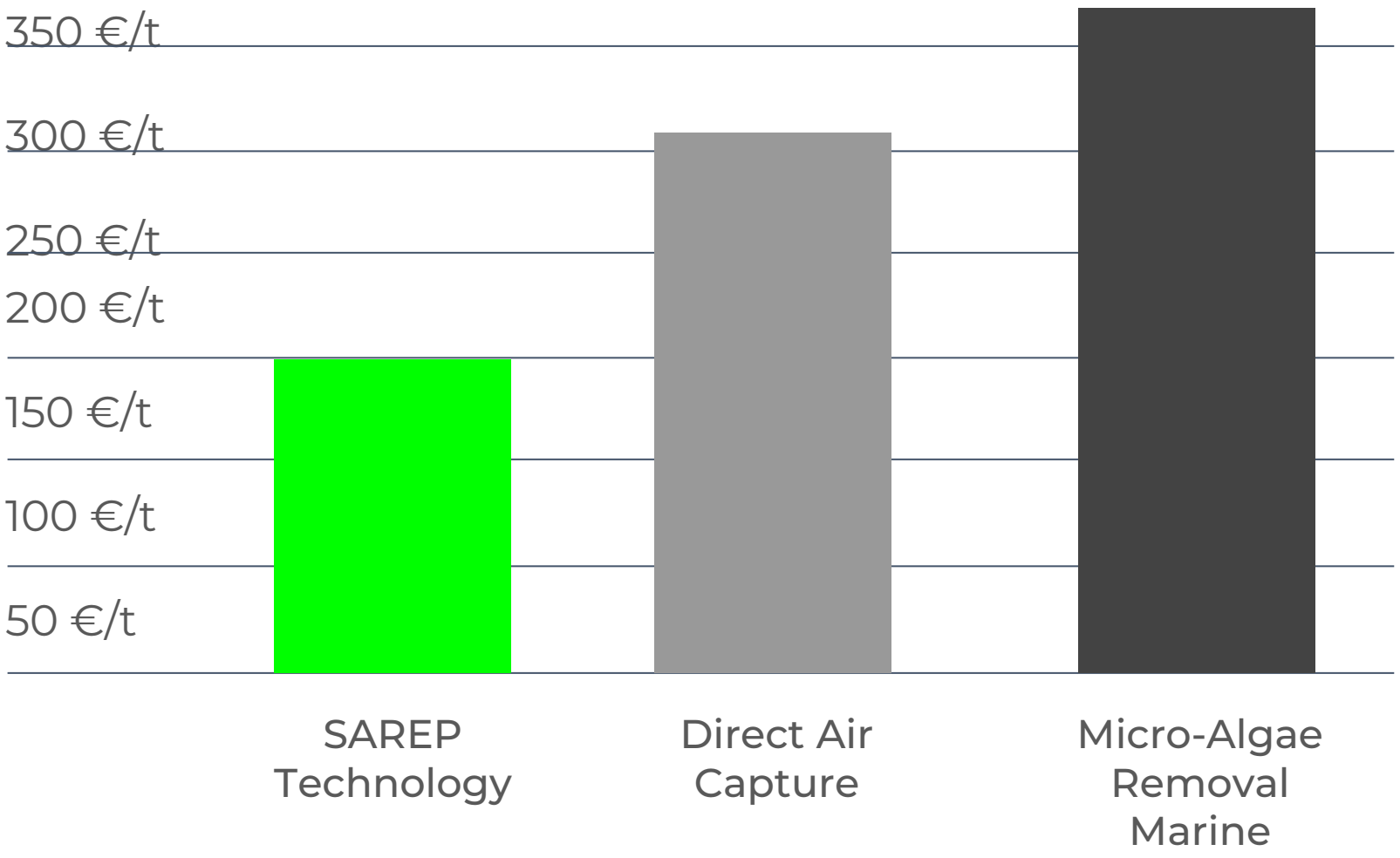
How the desert could look like: impressions from Nouakchot



Acacia africans

SAREP Technology is <u>less expensive</u> then existing solutions

Carbon Offset Price €/t CO2 in 2023

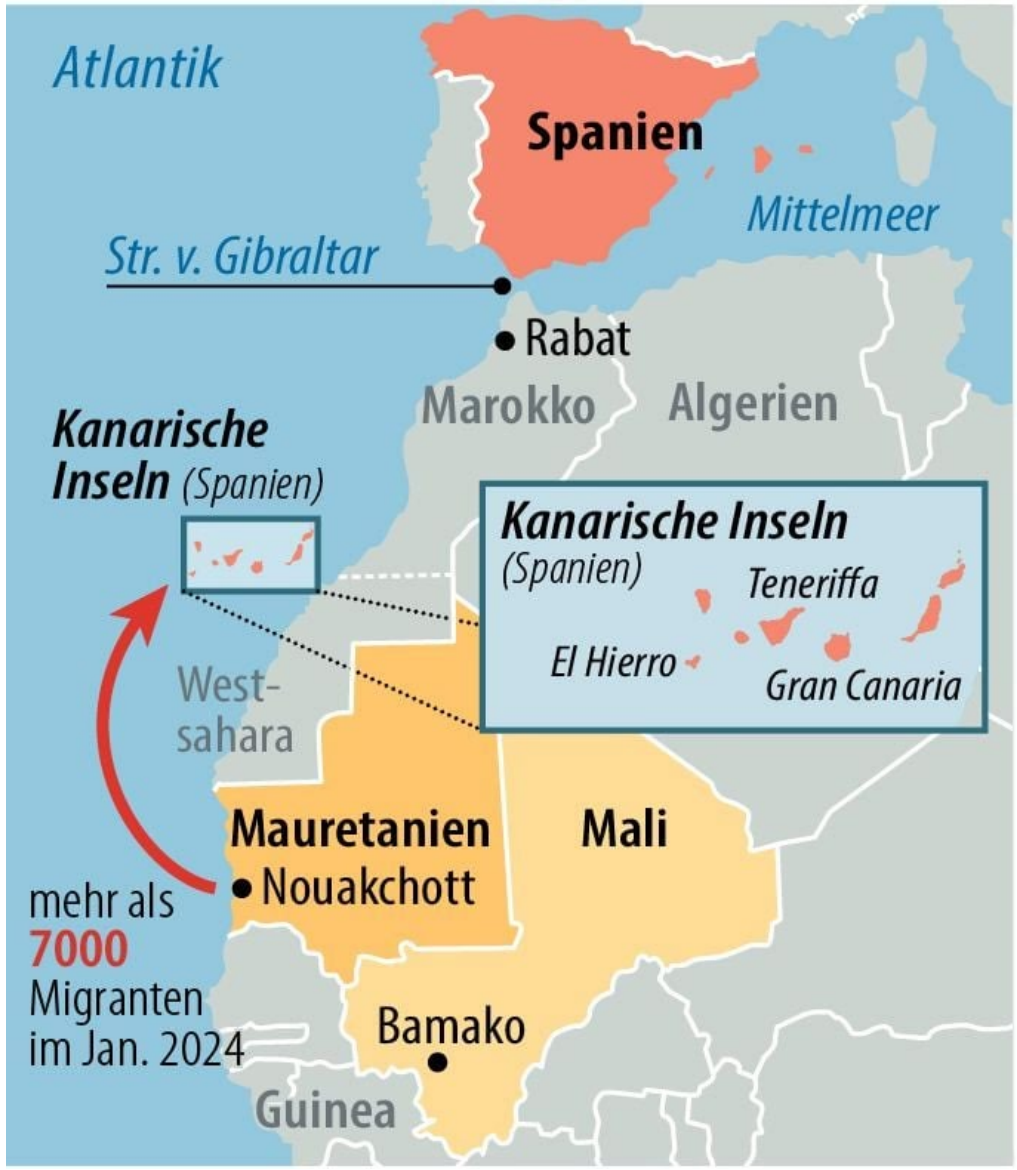


SAREP Technology is:

- less expensive than existing solutions
- is highly scalable, due to little to non proprietary technology
- presents the most efficient way to capture CO2 on scale
- presents a value adding solution to CO_2 removal

Why Mauretania?

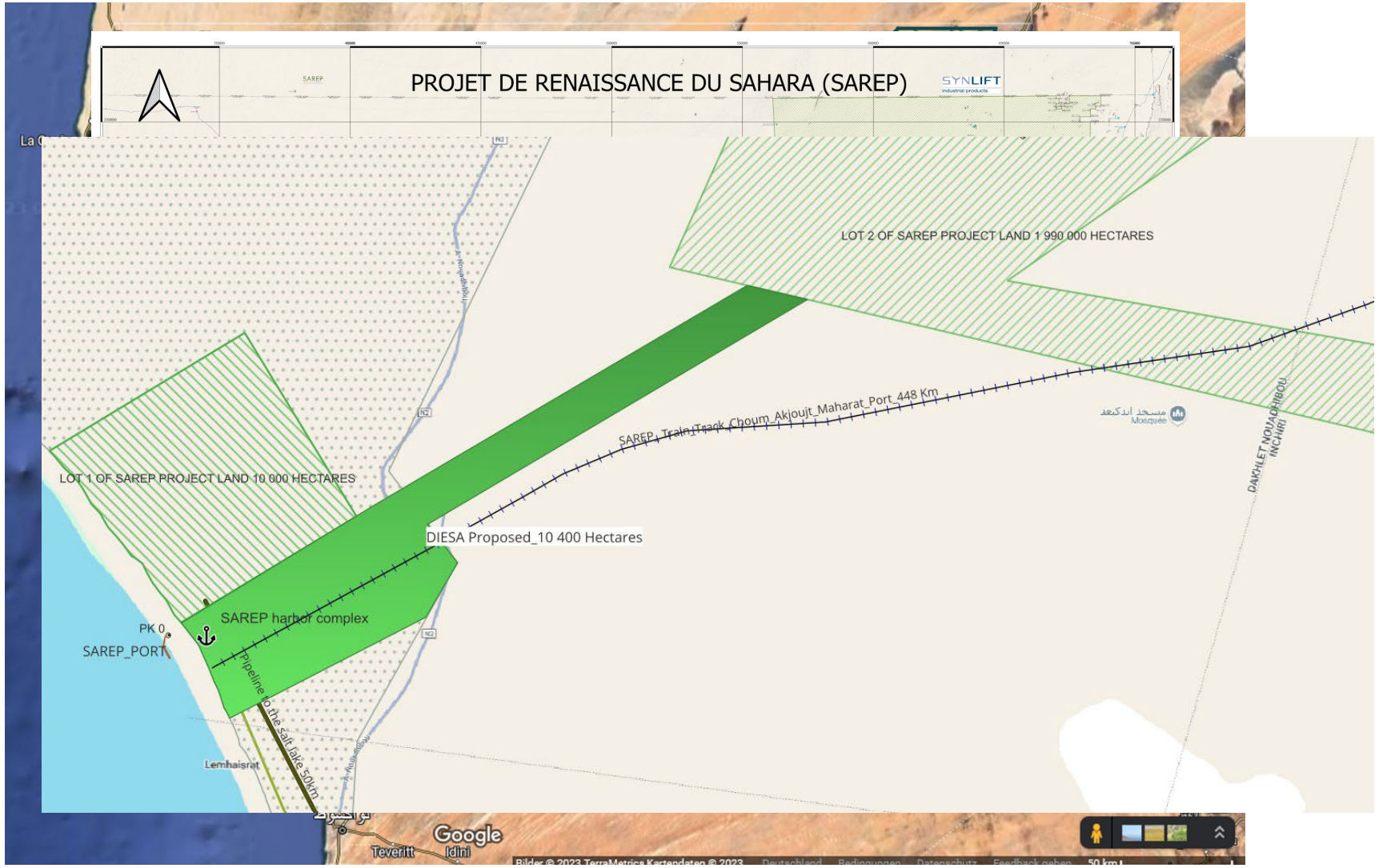
- Mauretania one of the most seriously affected countries by climate change
- Mauretania suffering from refugee crisis
- Mauretania as a starting point for illegal migration to Europe
- Mauretania with logistical options for mineral resources, hydrogen and biogenic commodities
- Mauretania with a huge potential in water, renewable energies and land



Zone du projet

Côte de la Mauritanie (2,000,000 ha)

Initial Project Region



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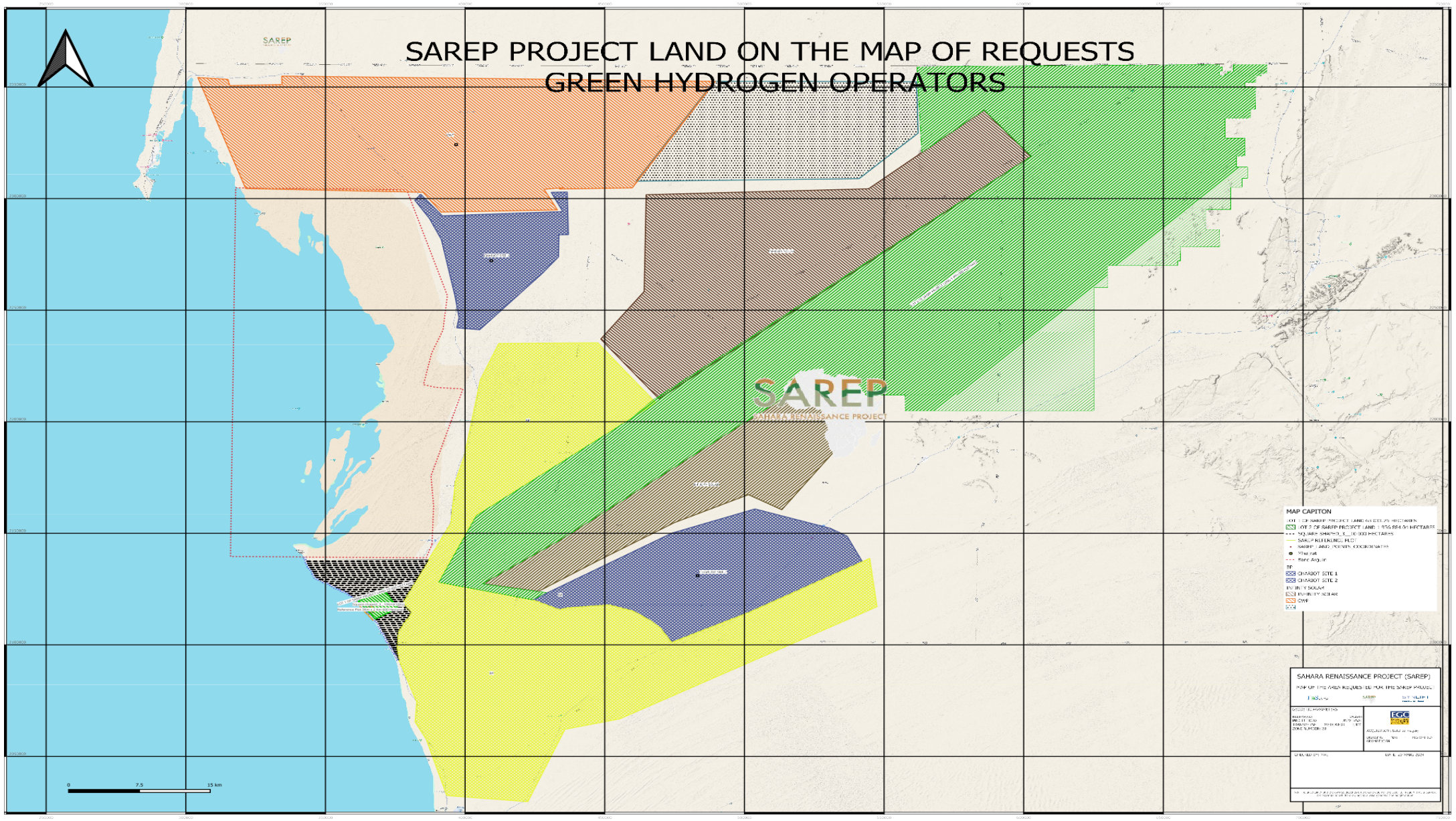
Hydrogen in Mauretania



Where it begins….

HILUX
TA

SAREP office opening and participation of local communities

SAREP Management Team

Example: Jatropha curcas | High yield through fertigation

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_2/ha/year

10,000 ha yield →

- 20,000 t oil/year
- 250,000 t CO_2/year
- 20,000 t protein /year
- 6,000 t biochar/year

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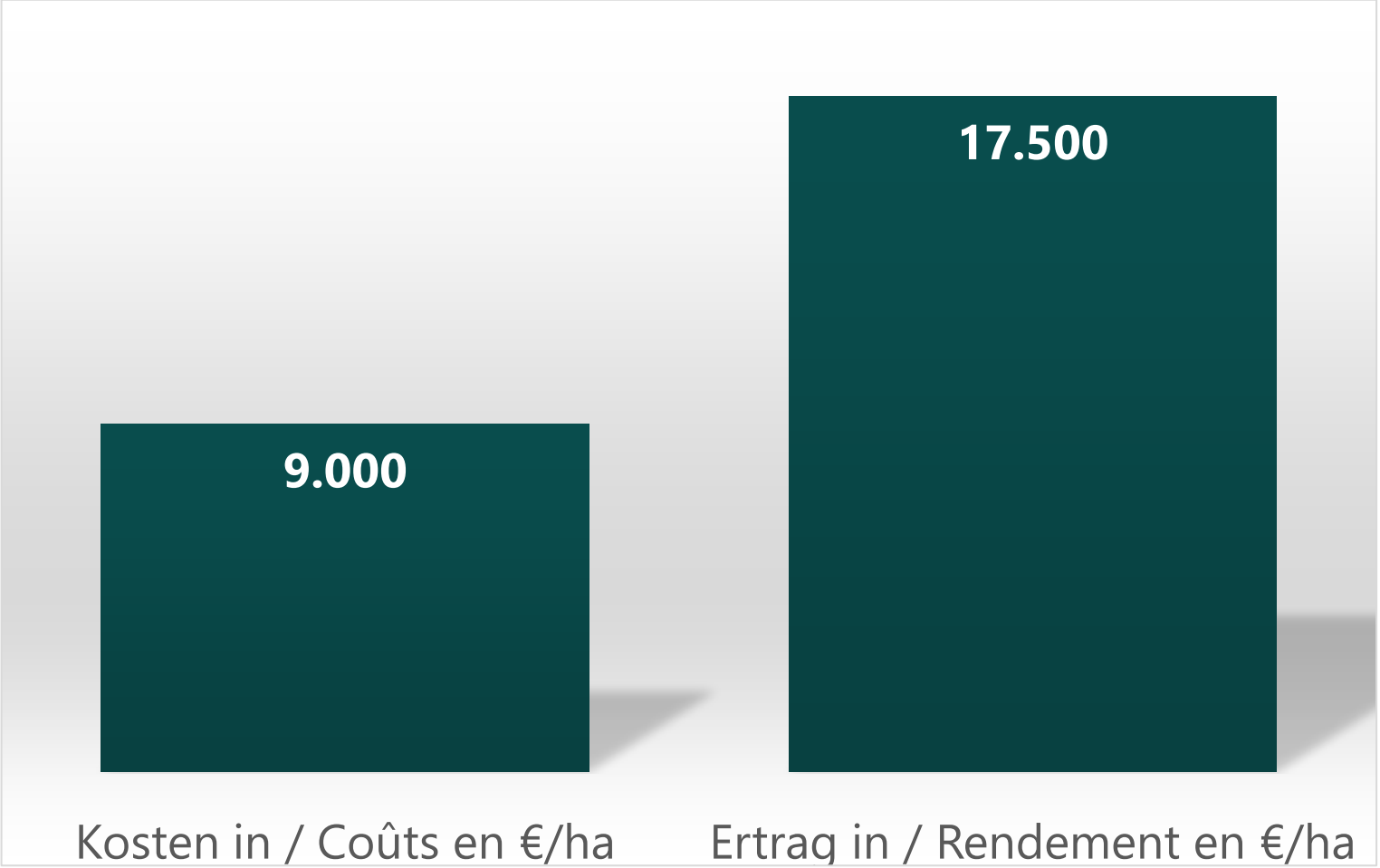
Onion farming: growing demand in Africa approx. 40 kg/cap/year

SAREP onion business case



Phase 1 „Reference plot“ LCoW 1,60 €/m³

10 Mio. € Investment

Key facts:

- 1,000 m³/d desalinated water
- 25 ha Prosopis juliflora etc.
- 5 ha onions and staple food for local demand
- 5 ha parc with showroom, boarding house, education center
- 20 trainees, 2 managers
- EIA and social impact study

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Phase 2 „Pilot“: LCoW 0,69 €/m³

90 Mio. € Investment

Key facts:

- 20,000 m³/d desalinated water
- 10,000 m³ sold to Nouakchot *(0,85€/m³)*
- 300 ha Prosopis juliflora etc.
- 40 ha onions and staple food for local demand
- 10 ha Jatropha curcas / Moringa oleifera

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Phase 3 „1st Standard Plot“ – 65,000 ha; 5,8 Mrd. Invest.; LCOW <0,40€/m³

Industrial Commercialisation up to 2 Mio. ha

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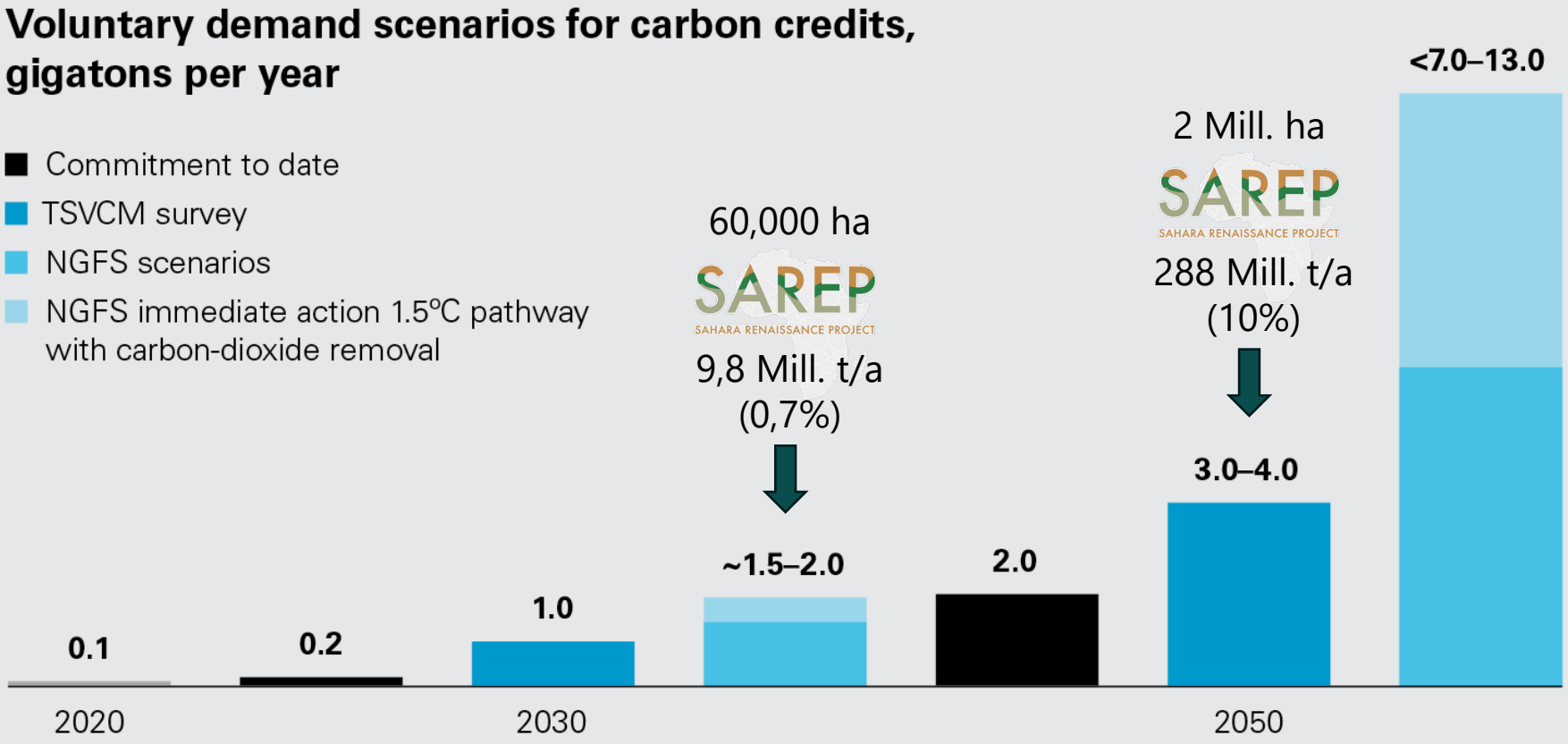
SAREP harbour – Potential for Mauritania

Carbon Removal Certificates Demand in billion tons



Source: "A blueprint for scaling voluntary carbon markets to meet the climate challenge," McKinsey & Company

EIB predicts*:
183 USD/tCO in 2025
277 USD/tCO in 2030

Whitecase predicts:
50 USD/tCO in 2030
300 USD/tCO in 2050

*Source: World Bank (2021), State and Trends of Carbon Pricing / European Investment Bank (2020), EIB Group Climate Bank Roadmap 2021-2025

CO_2 Price Development

Source	Issuance 2020 (million t CO_2/a)	Demand 2030 (million t CO_2/a)	Demand 2050 (million t CO_2/a)	Price 2030 ($/t$CO_2$)	Market Volume 2030 (billion $/a)
Credit Suisse	282	1,000	5,000<	50-100	50-100
TSVCM	282	1,000-2,000	7,000-13,000	5-100	30-180
MSCI Trove Research	282	500-1,500	-	20-50	10-40
Bloomberg NEF	282	1,000	5,000<	47-224	190
McKinsey	282	1,000-2,000	6,000-10,000	40-80	40-80
BCG	282	500 -1,500	-	20-40	10-40
SwissRe	-	-	-	200	-
World Bank	-	-	-	61-122	-
EIB	-	-	-	250	-

Sources: Credit Suisse (2022), TSVCM (2021), Trove Research (2021), Bloomberg NEF (2022), McKinsey & Company (2023), (BCG & Shell, 2023), SwissRe (2023), World Bank (2023), EIB (2020)

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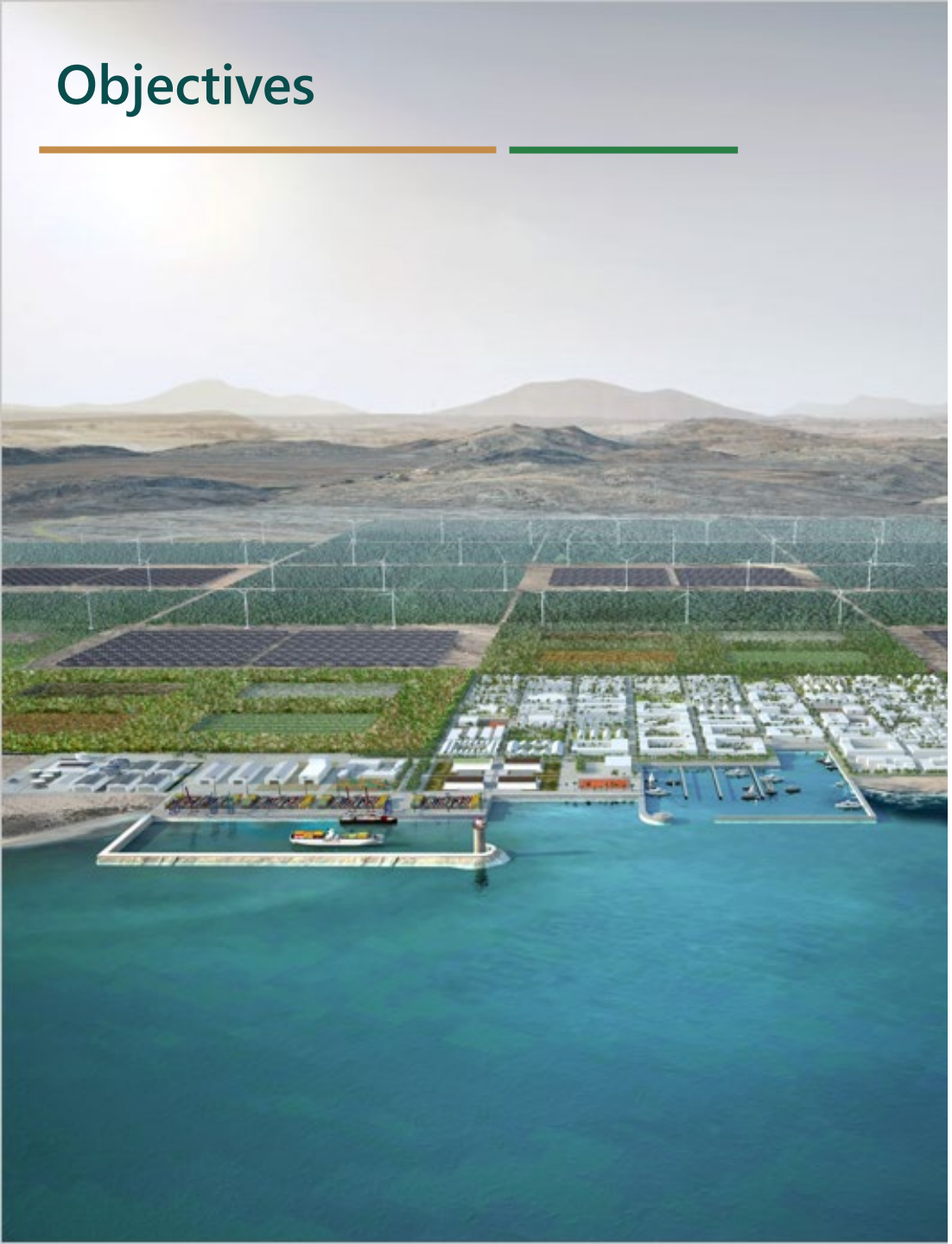
Objectives



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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

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Economic analysis

		budget figues		extrapolated
Parameter	**Unit**	**Pilot plot**	**Standard plot**	**Target dimension**
Construction time	a	4	4	10
Water capacity	m^3/d	20,000	2,000,000	54,000,000
Water supply to Nouakchot	m^3/d	10,000	200,000	200,000
Levelized Cost of Water	**€/m³**	**0.69**	**0.38**	**0.26**
Water Sales Price	€/m³	0.85	0.85	0.85
Afforestation	ha	339	70,000	1,960,000
Land use cost	€/ha	0.0	0.0	0.0
CO_2 removal	tCO_2/a	48,000	9,590,000	268,520,000
CAPEX	**k€**	**76,000**	**5,789,000**	**153,987,400**
Renewable Energy (PV+Wind)	k€	18,903	1,439,861	38,300,313
Reverse Osmosis	k€	39,000	2,970,671	79,019,850
Irrigation System	k€	6,945	529,036	14,072,353
Afforestation	k€	5,055	385,037	10,241,980
Training Center / SAREP Headquarter	k€	6,185	471,131	12,532,094
Working Capital	k€	8,981	170,000	4,522,000
Trade Working Capital	k€	1,200	22,715	604,222
Development Cost	k€	7,781	147,285	3,917,778
CO_2 start price	€/tCO_2	65	85	85
CO_2 price inflation	p.a.	5%	5%	5%
EBITDA-Margin		33.7%	54.2%	>60%
WACC		3.9%	8.4%	12.0%
IRR		4.4%	9.2%	>12%
PBP	a	29	27	<25

- SAREP at scale constitutes a profitable investment option!
- SAREPs financial result oscillates from rather low (4%) to high (12%) IRR, depending on size (economy of scale) and the behaviour (development) of the most sensitive variables, with the top 3 being ranked:
  1. Yield expectation *(carbon removal performance)*
  2. Levelized Cost of Water *(and/or water consumption per ha/a)*
  3. Carbon certificate *(and/or commodity)* price

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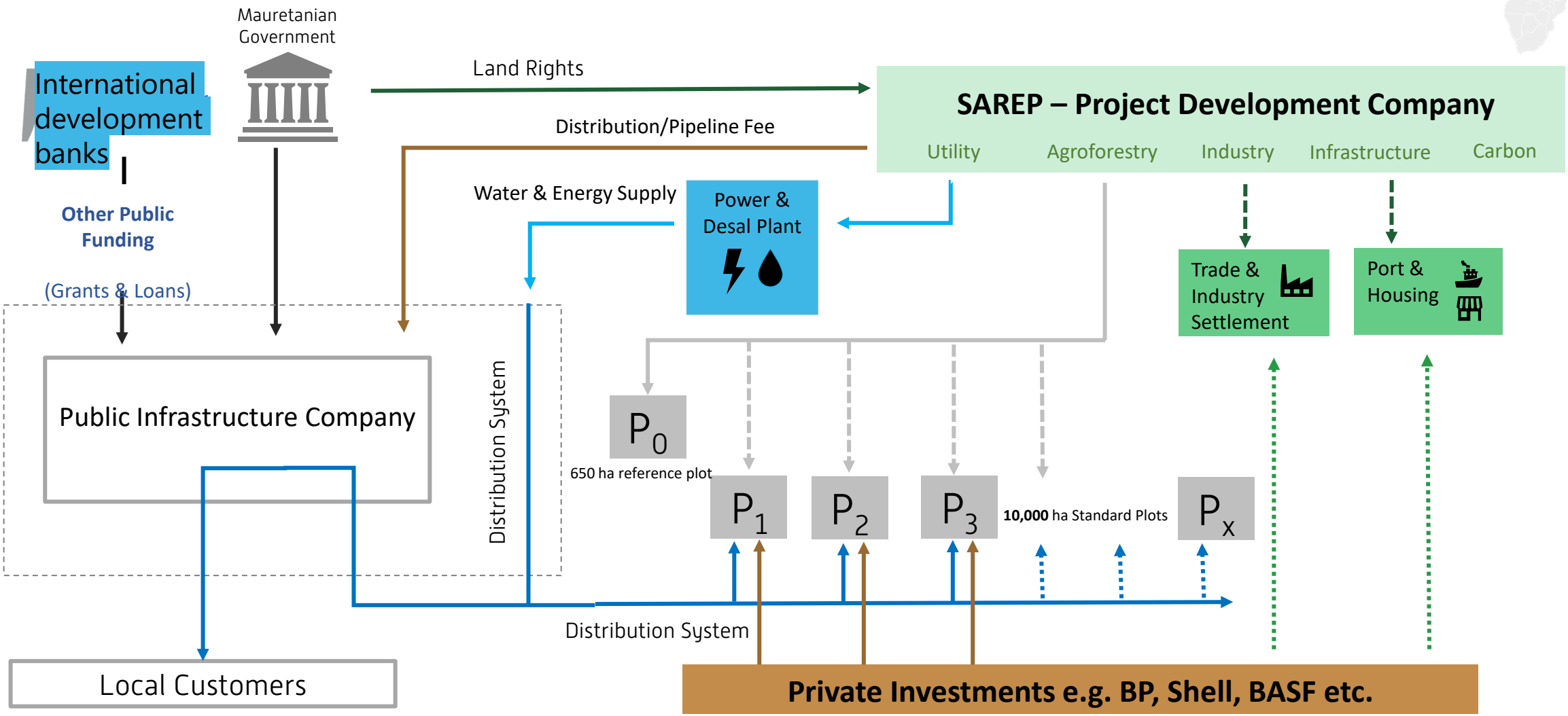
Proposed Stakeholder Structure



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Objectives

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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

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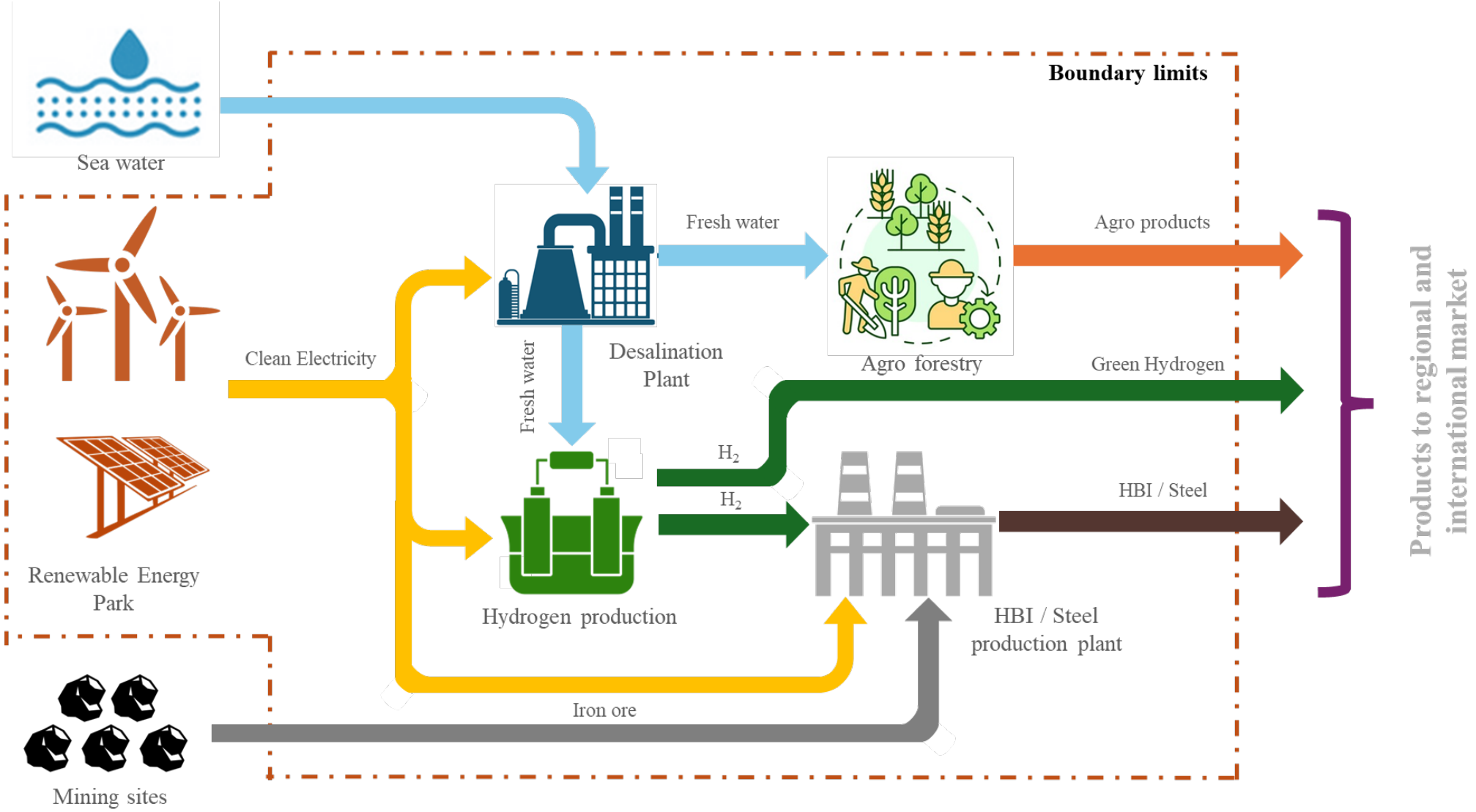
Business Model – Unfolding Synergies



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Using brine in salt lake to cultivate Salicornia bigelovii

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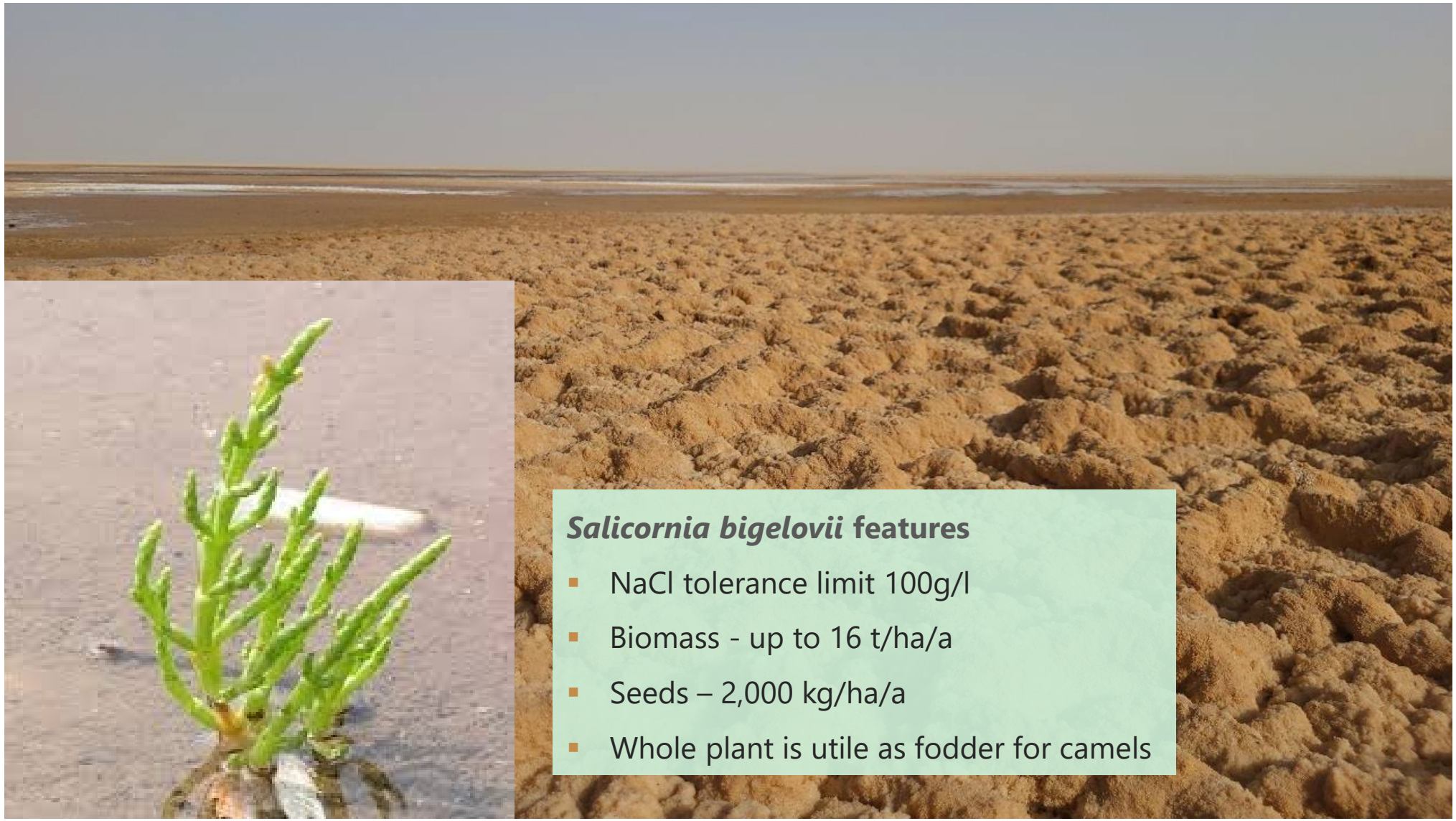
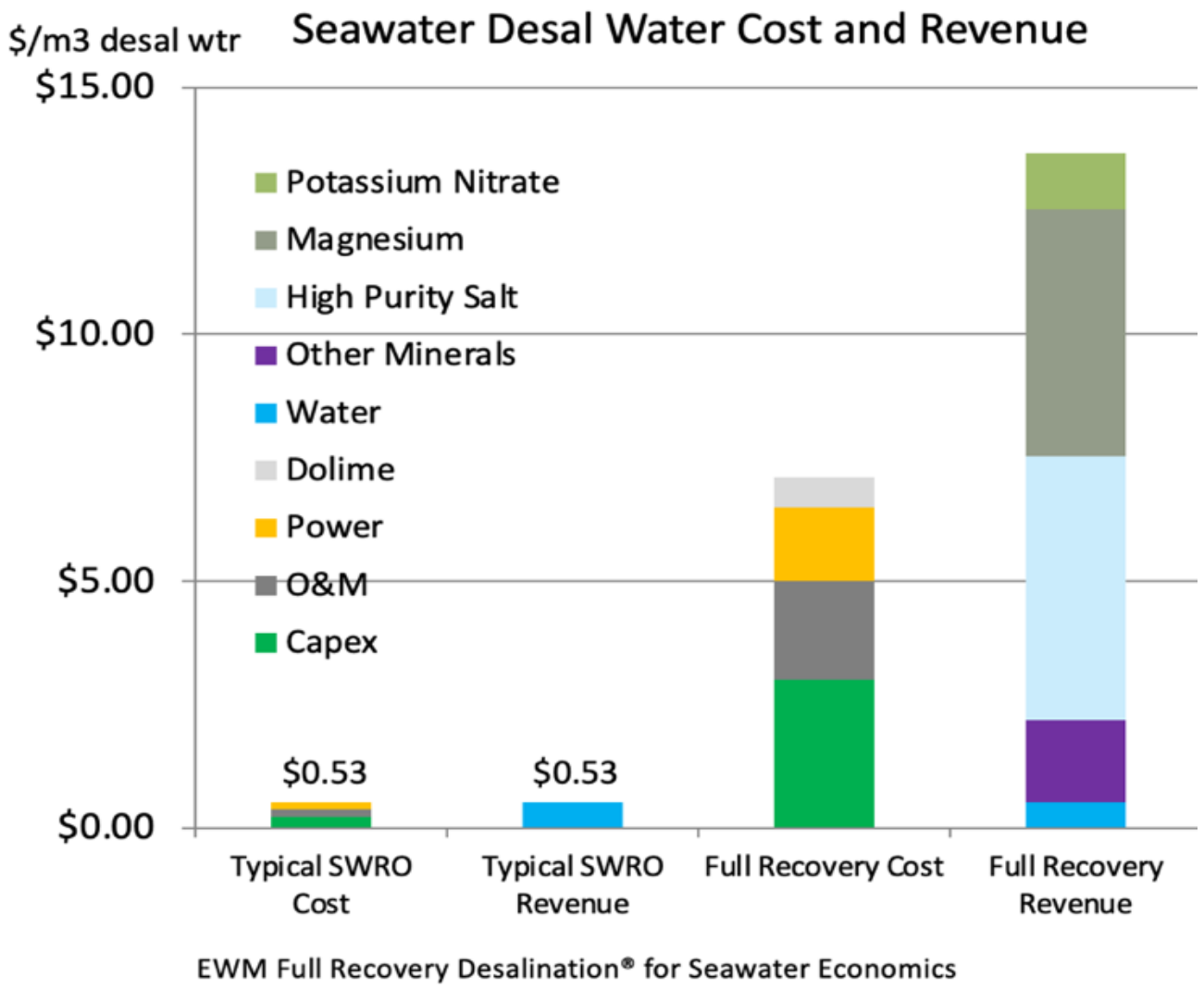


***Salicornia bigelovii* features**

- NaCl tolerance limit 100g/l
- Biomass - up to 16 t/ha/a
- Seeds – 2,000 kg/ha/a
- Whole plant is utile as fodder for camels

Source: http://www.queller.org/wuestenspargel/

There is more to brine….



Mining of approx 38.000 t Mg

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Sea water added value

Seawater ingredients: Na, K, and Mg-containing salts, Bromine, are produced in downstream process

Sea water parameter

Parameter	Unit	Value
Chloride (Cl^-)	mg/L	20,615
Sodium (Na^+)	mg/L	11,450
Sulfate (SO_4^{2-})	mg/L	2,878
Magnesium (Mg^{2+})	mg/L	1,374
Calcium (Ca^{2+})	mg/L	447
Potassium (K^+)	mg/L	411
Bicarbonate(HCO_3^-)	mg/L	151
Strontium (Sr_2^+)	mg/L	42
Bromide (Br^-)	mg/L	65
Iodide (I^-)	mg/L	1
Lithium (Li)	mg/L	0.1

Futuristic potential

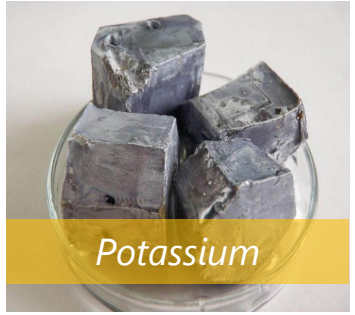
Sea water intake: *36.5 Mil. m³/a (100,000 m³/d)*

Min. 14.6 Mil. m³/a

88,461 t/a

2,373 t/a

50,151 t/a



15,002 t/a

16,316 t/a

**Theortical basis*

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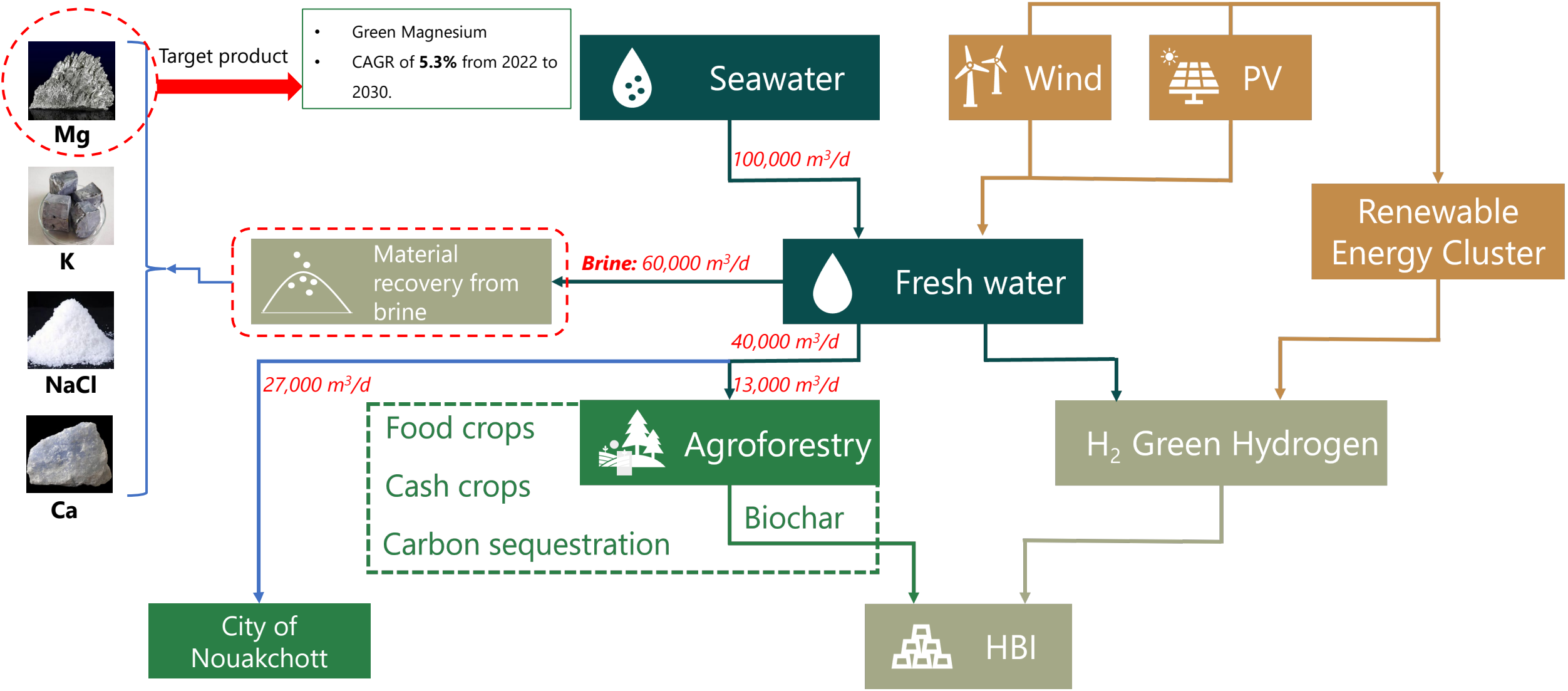
SAREP Synergies-Phase 1



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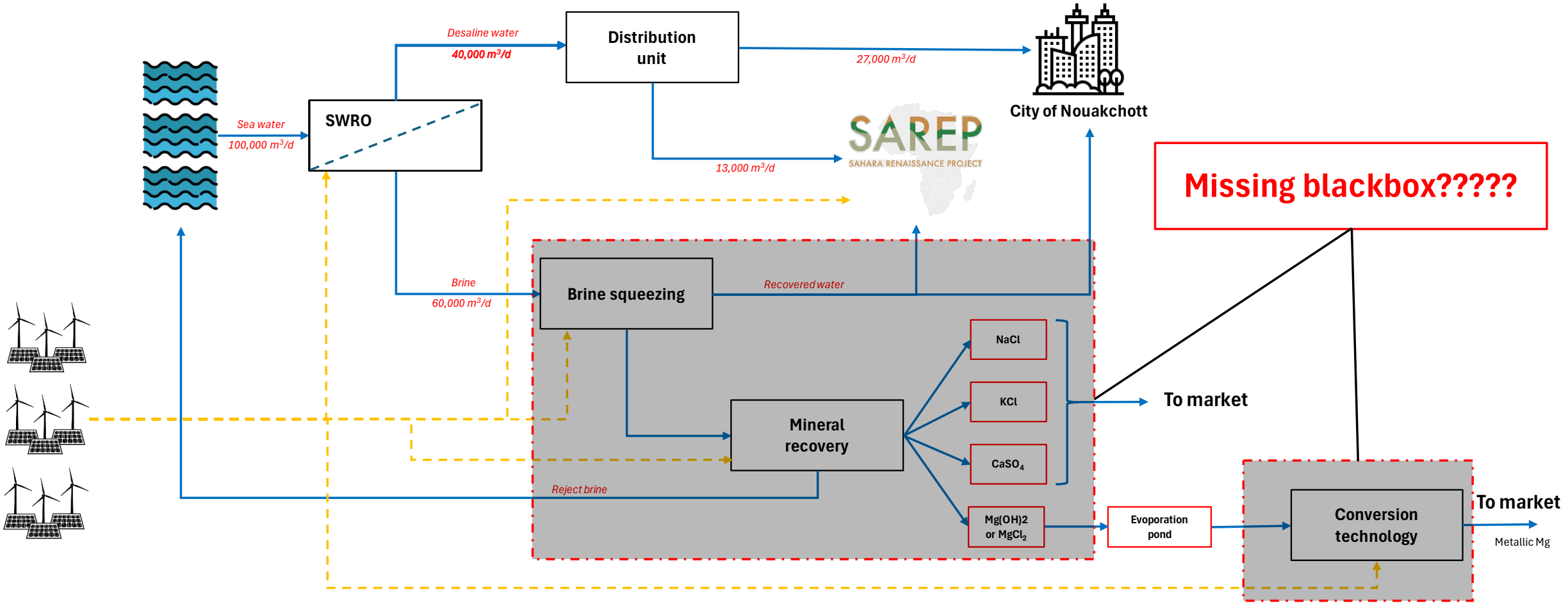
Brine Management synergies



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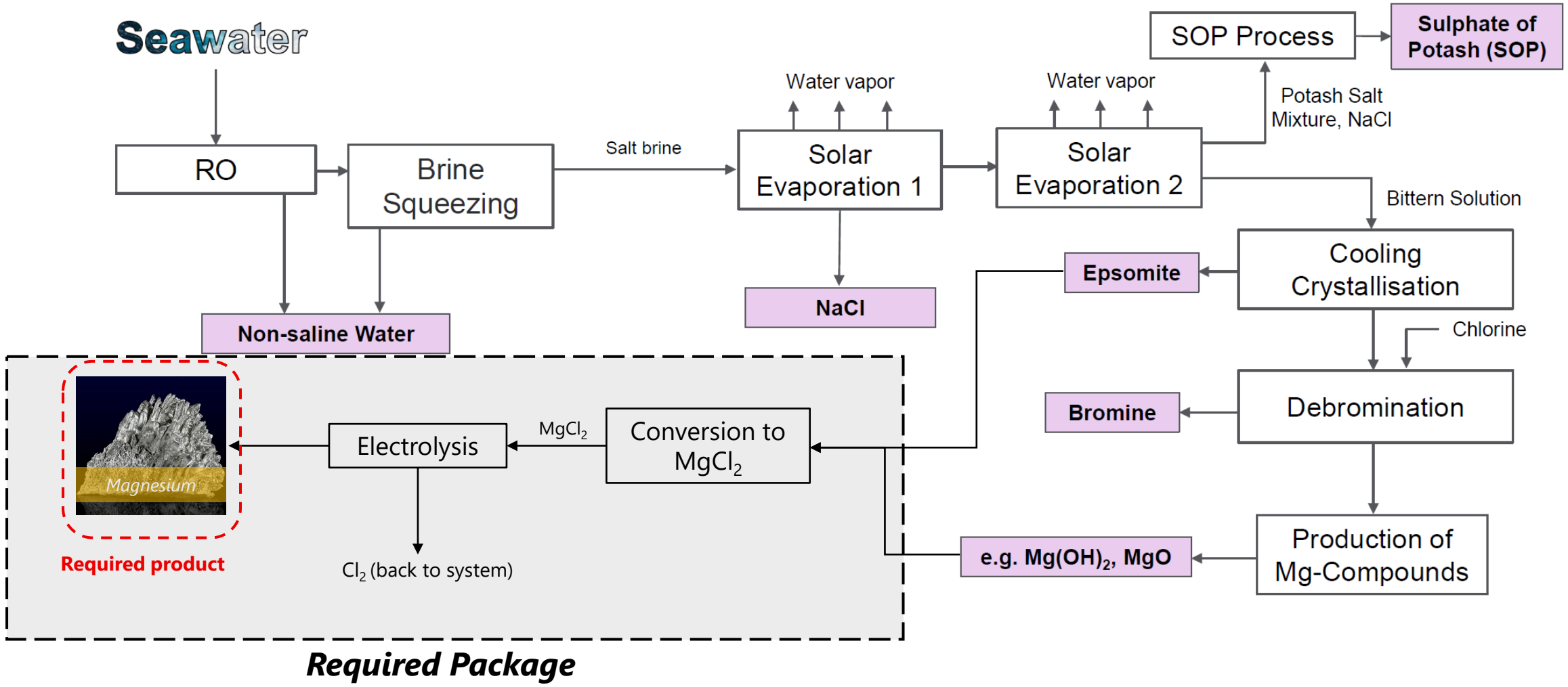
Possible flow diagram for Mg recovery



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COP28 Dubai - signing of MoU

Summary

SAREP
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- SAREP uses **state of the art technologies** to solve pressing worldwide problems
- SAREP offers **affordable potable water** and **food for local population**
- 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 employment and education in for **local people and migrating refugees**

Green business model for climate mitigation, carbon storage, poverty alleviation, GHG neutral steel production and food security

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SYNLIFT industrial products

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