



HYDROGEN  
ENERGY

**HYPHEN**

# Engineering Procurement and Construction Masterclass Overview

**HYPHEN: Masterclass Overview**  
November 2023  
Version 1.0



Deadvlei – Namib-Naukluft National Park Namibia  
([www.pexels.com](http://www.pexels.com))

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The technical contents of this presentation are only early indications of potential implementation. They are not firm and most have a high likelihood of changing during the development of the project over the next 12 to 24 months



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## Presenter Introduction



### **Senior Project Developer for Hyphen since mid-2022**

Responsible for the development and de-risking full technical workstream, from upstream solar and wind generation, through to the export port infrastructure

### **Chairperson for REIAoN since 2019**

Responsible for the restructuring and rebranding of the industry body. Representing 80 members (IPPs, installers, suppliers, contractors and consultants). Advocacy and promotion on behalf of the RE private sector.

### **Previous Experience**

Part of the team who developed and built several of Namibia's first solar PV and first wind project between 2015 and 2021. Included project development across SADC and including desalination Civil Engineering background in water and servicing.

## Contents:



Land allocation and project overview



Project components & scaling  
Additional discussion on CUI



Project timeline schedule



Engineering workstreams and capacity  
Engineering Deep Dive - Wind

## Contents:



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Project components & scaling



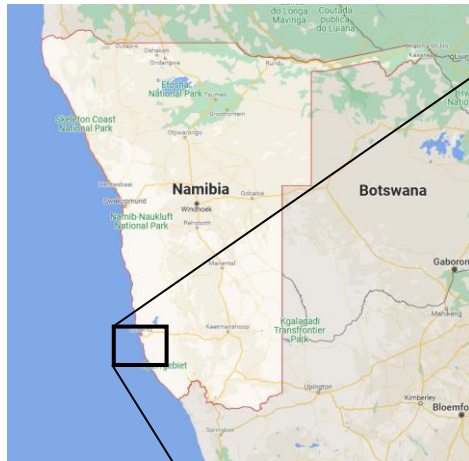
Project timeline schedule



Engineering workstreams and capacity



# Hyphen project land parcels and context



- L** Lüderitz Port Town
- A** Aus Settlement
- A** Angra Point
- S** Springbok land parcel
- D** Dolphin land parcel

Average wind speed:  
> 10 m/s (like offshore)

Solar: 2 600 – 2 800 full-  
load hours p.a.

# The Hyphen project plans to produce 2Mtpa of Green Ammonia

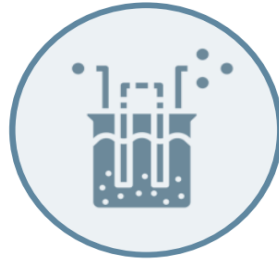


## Hyphen Output KPIs



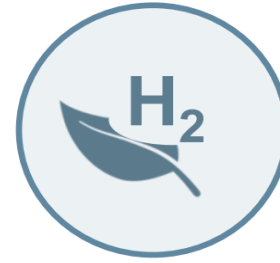
**Wind and Solar  
Energy**  
*6-8 GW*

- The project will produce **green energy (wind and solar)** benefitting from Namibia's exceptional potential, land availability and Government's political impetus



**Electrolysis**  
*2.5-3.5 GW*

- The energy produced will primarily be used to **electrolyze desalinated sea water** and separate hydrogen ( $H_2$ ) from Oxygen ( $O$ )
- **Desalination also uses energy from the wind and solar plants**



**Green Hydrogen**  
*350,000 tpa*

- Green hydrogen is transported to the Lüderitz port through pipelines



**Green Ammonia**  
*c. 2 Mtpa*

- **Hydrogen is transformed into ammonia ( $NH_3$ )**
- Green ammonia can then be **shipped from the port to other markets**, primarily focusing on **Europe**
- **2Mt per annum represents c. 50% of Germany's total ammonia consumption**

*Conservative estimates<sup>1</sup>*

- To manage project risk and ensure smooth scaling up, the Project will be developed in two phases of the same size (c. 1Mtpa ammonia each)

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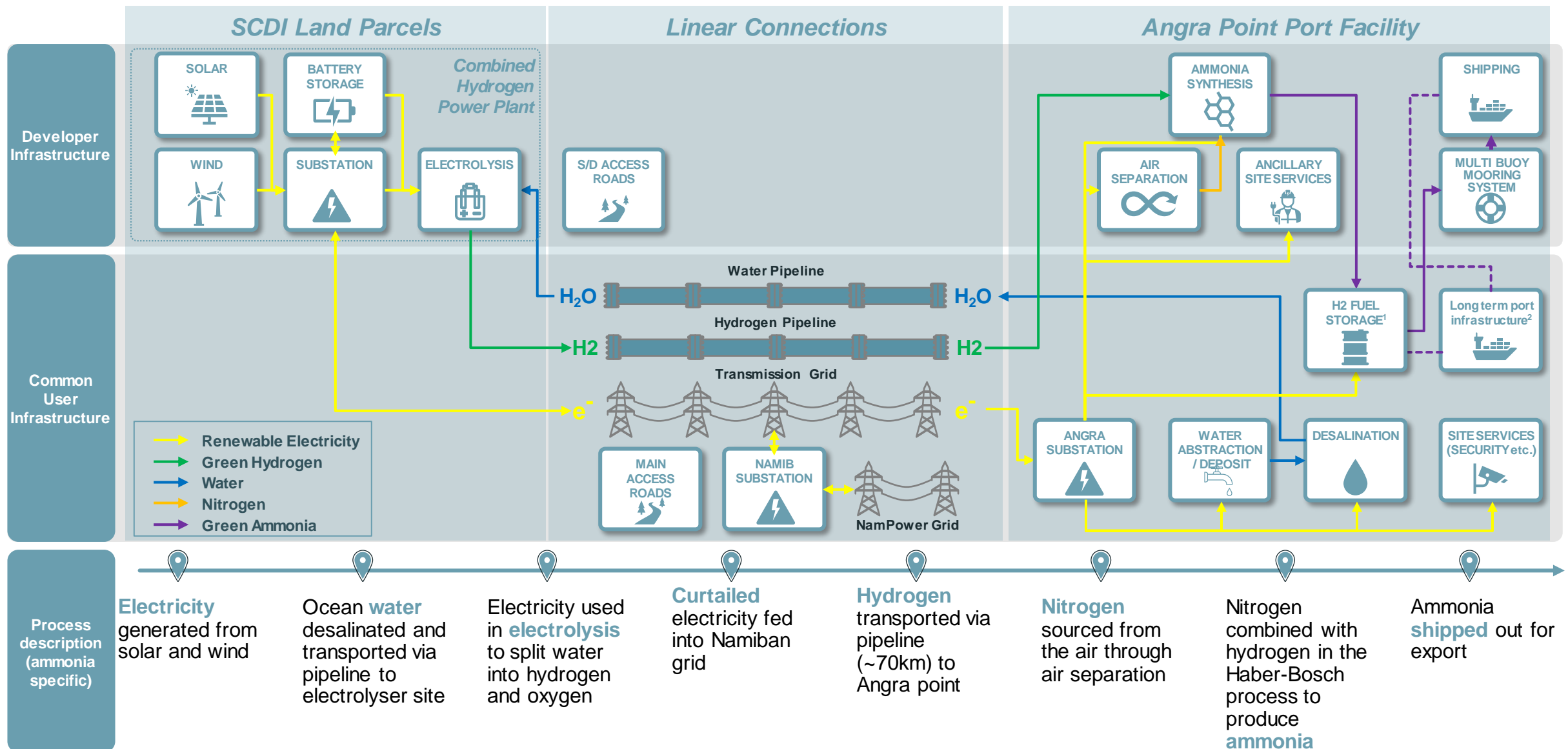
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# Hyphen Project Components



1. Could also store other synthetic fuels. The product stored as part of the first project is ammonia 2. Long term physical port infrastructure to be build in the future, with exact ownership and operating structure to be determined

# Hyphen project area and connection to Lüderitz port

Lüderitz port area:  
ammonia plant, air  
separation, desalination  
and multi-buoy port  
terminal

Green  
hydrogen

Desalinated  
seawater

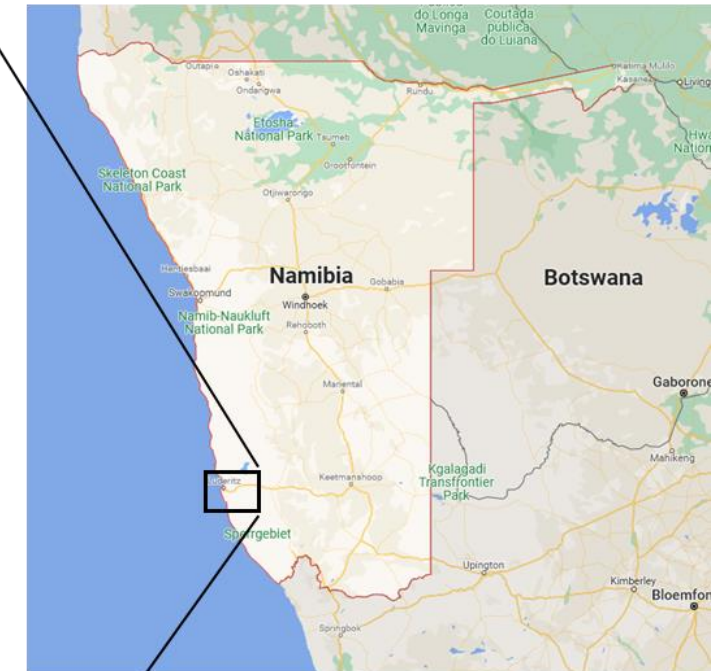
Renewable dispatchable  
power via overhead line

Existing transmission  
line from NamPower

Electrolysis site  
for hydrogen  
production

Concession areas put out to  
tender by the Namibian  
government (4,000 km<sup>2</sup>)

Renewable Electricity  
Green Hydrogen  
Water



Average wind speed:  
> 10 m/s (like offshore)

Solar: 2 600 – 2 800 full-  
load hours p.a. (only  
1 000 in Germany)

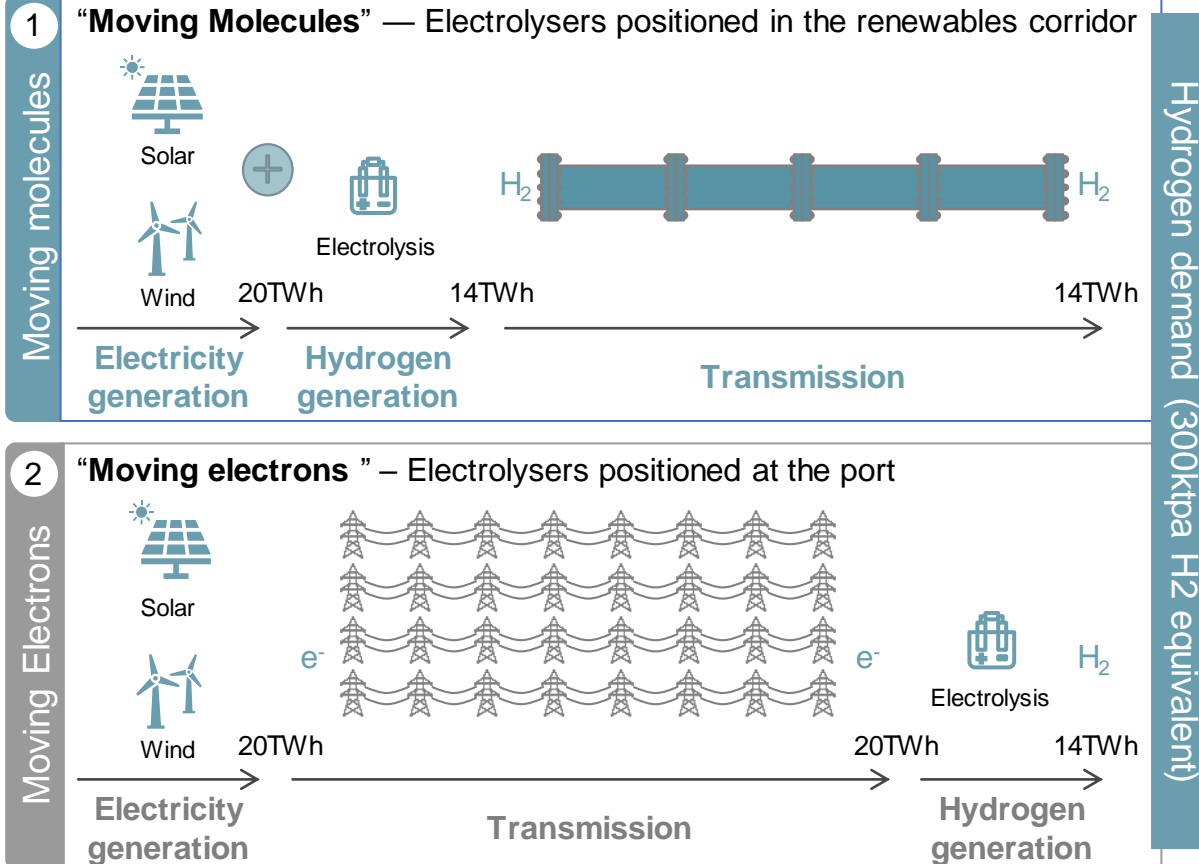
# “Moving molecules” is the optimal technical solution



Theoretical project from scaling perspective

Two distinct options technically possible...

Preferred option



... with “moving molecules<sup>2</sup>” being the preferred solution

## Environment

1x 1,400mm hydrogen pipeline can accommodate 3Mtpa of GH<sub>2</sub>, equivalent to approximately 50 GW of RE. This would be equivalent to 48x 400kv lines

## Cost

Pipeline cheaper per unit energy and length:  
Capital cost of pipeline is \$c 6-10 per kg/100km and for transmission it is \$c 11-15 per kg/100km

## Energy Transport

Transmission losses<sup>1</sup> associated with both options, because of electrolyser inefficiencies, the pipeline requires 30% less "energy" to be moved, resulting in more effective deployment of capital and improved overall system efficiency

## Operability

Pipeline offers buffer capacity to smooth out variability and optimize potential uptime of downstream processes and equipment

## Land availability

Area around Angra Point in Lüderitz is limited & would not be sufficient to accommodate transmission line infrastructure, as well as electrolysers associated with the full development potential of the SCDI, when choosing "Moving electrons"

1. Transmission losses, pipeline leakages and compressor energy usage have not been shown explicitly. 2. A parallel grid will still be required to run downstream RE systems on green electricity, but this is of small scale. Generally, between 5% - 10% of total installed RE capacity depending on the downstream derivative process  
Source: RMI, Linde, Enertrag and BCG expert

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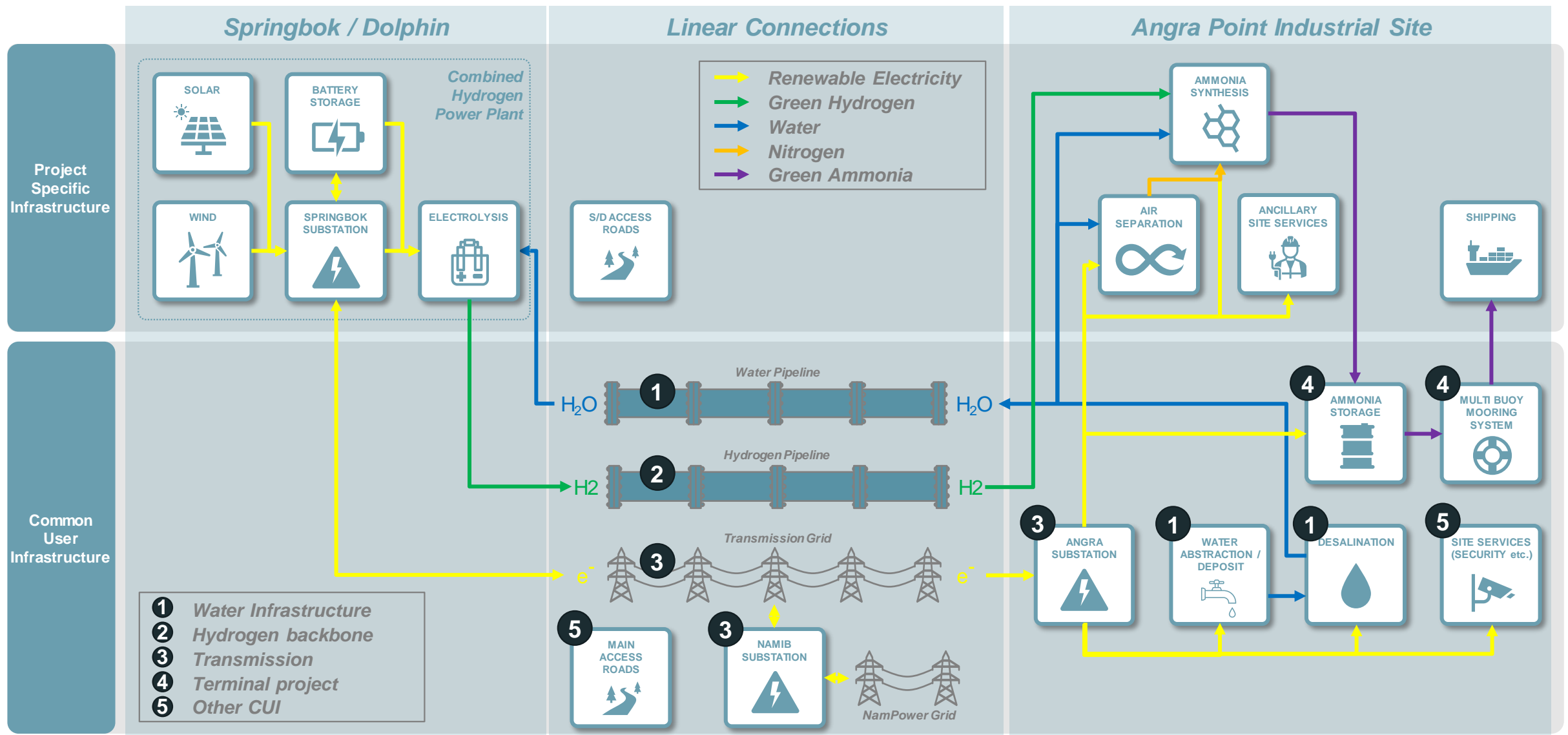
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Engineering workstreams and capacity

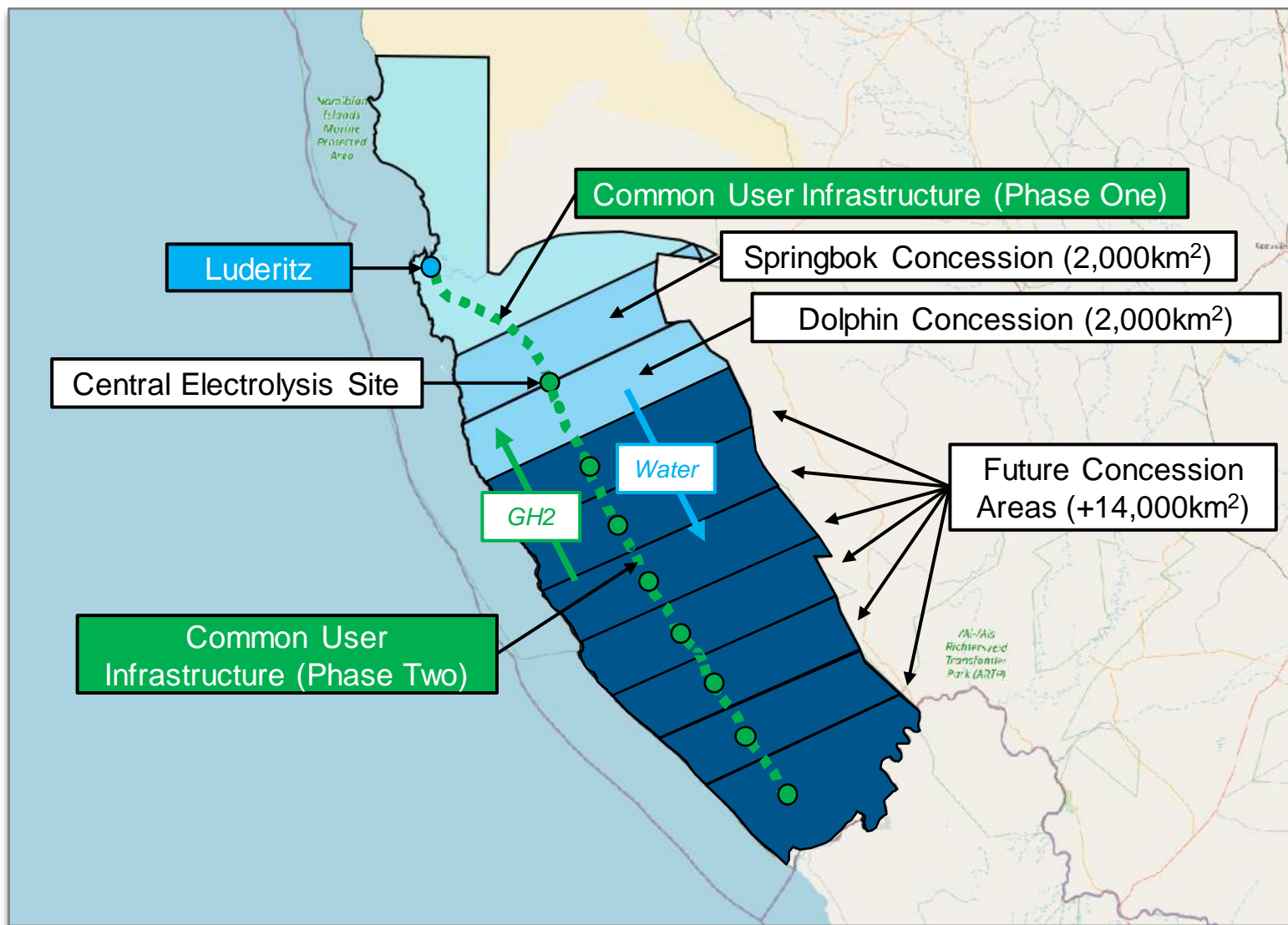


# Proposed Common User Infrastructure





# Namibia's first GH2 mega-project will unlock 'CUI' for future projects



## Common User Infrastructure ("CUI") Corridor



*Green Hydrogen Gas Pipelines*



*Water Pipelines*



*Transmission Lines*

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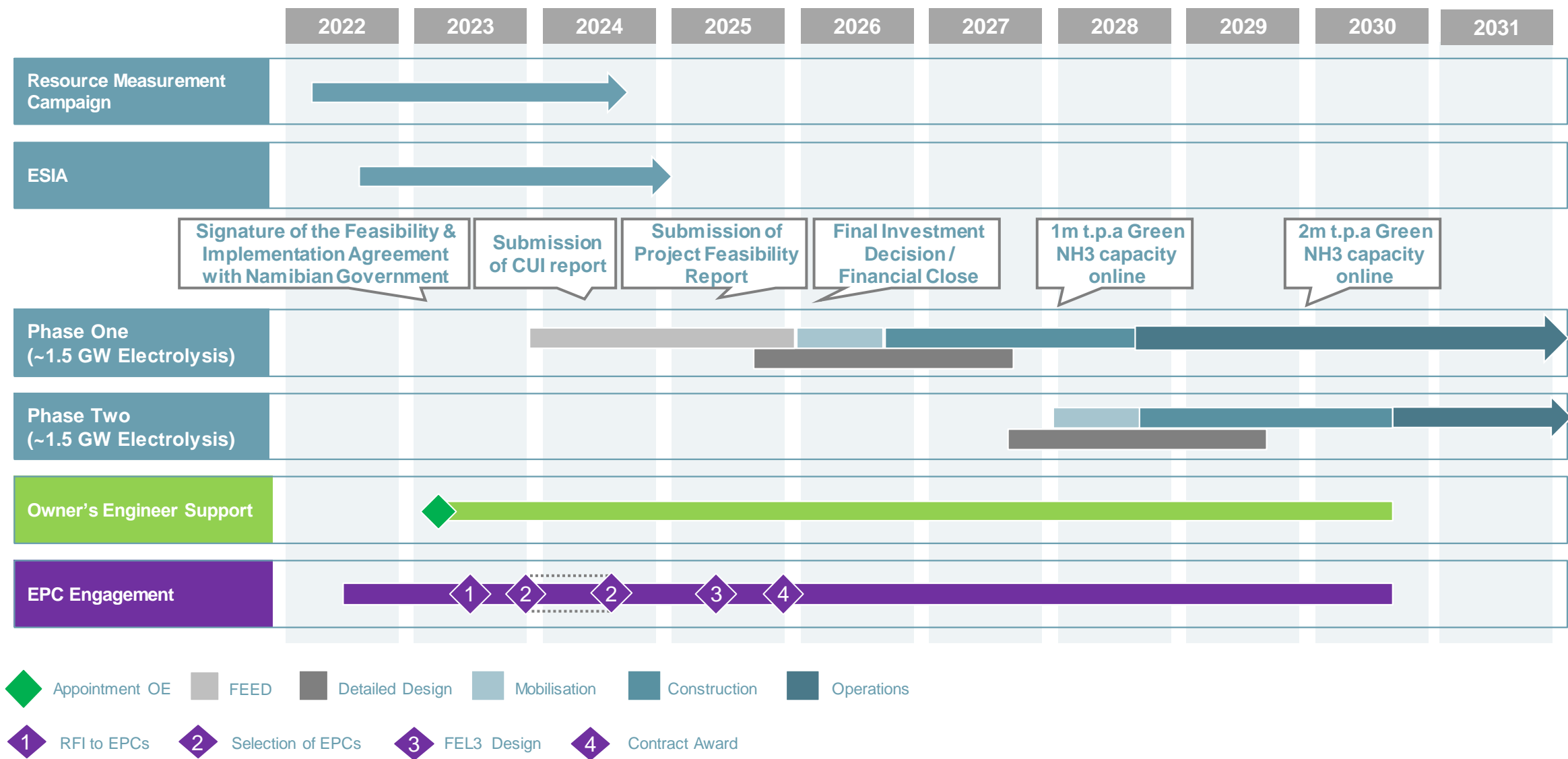


Project timeline schedule



Engineering workstreams and capacity

# Hyphen Timelines (High-level)



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# Hyphen is progressing with technical workstreams



## South Corridor Development Initiative (SCDI) infrastructure master plan

- Design of the SCDI Master Plan started
- Design of Lüderitz Port Master Plan started in partnership with Namport, Port of Rotterdam and Invest International



## Technical engineering studies

- Pre-feasibility study completed
- Initial meteorological mast locations identified
- Revised technical dimensioning study underway for wind and solar production
- 10 Met masts and 2 LIDAR systems due to be deployed on site



## Focus on: pre-FEED concept studies started for Hyphen-only infrastructure

- Wind and Solar
- Battery Energy Storage Systems (BESS)
- Electrolysis Cooling System
- Ammonia Loop
- Electrolysis
- Logistics study for the importation of equipment to site
- Port masterplan and ammonia export facilities



## Common user infrastructure early design work

- Desalinization
- Water & Hydrogen Pipeline
- Ammonia Storage
- Transmission
- Roads & Port



## Engineering Capacity Ramp-up

- Local engineering support and project management database and recruitment
- Experienced capacity building
- Procurement of **Owner's Engineering Partner** to
  - enable rapid capacity built, with required experience and skills
  - enable flexible internal resource ramp up & down keeping structure lean & fit for purpose
  - form part of Integrated Project Management Team (IPMT)
  - OE to provide functional specs for EPC



## Core Design Principal

Only specify off-the-shelf trusted designs and components



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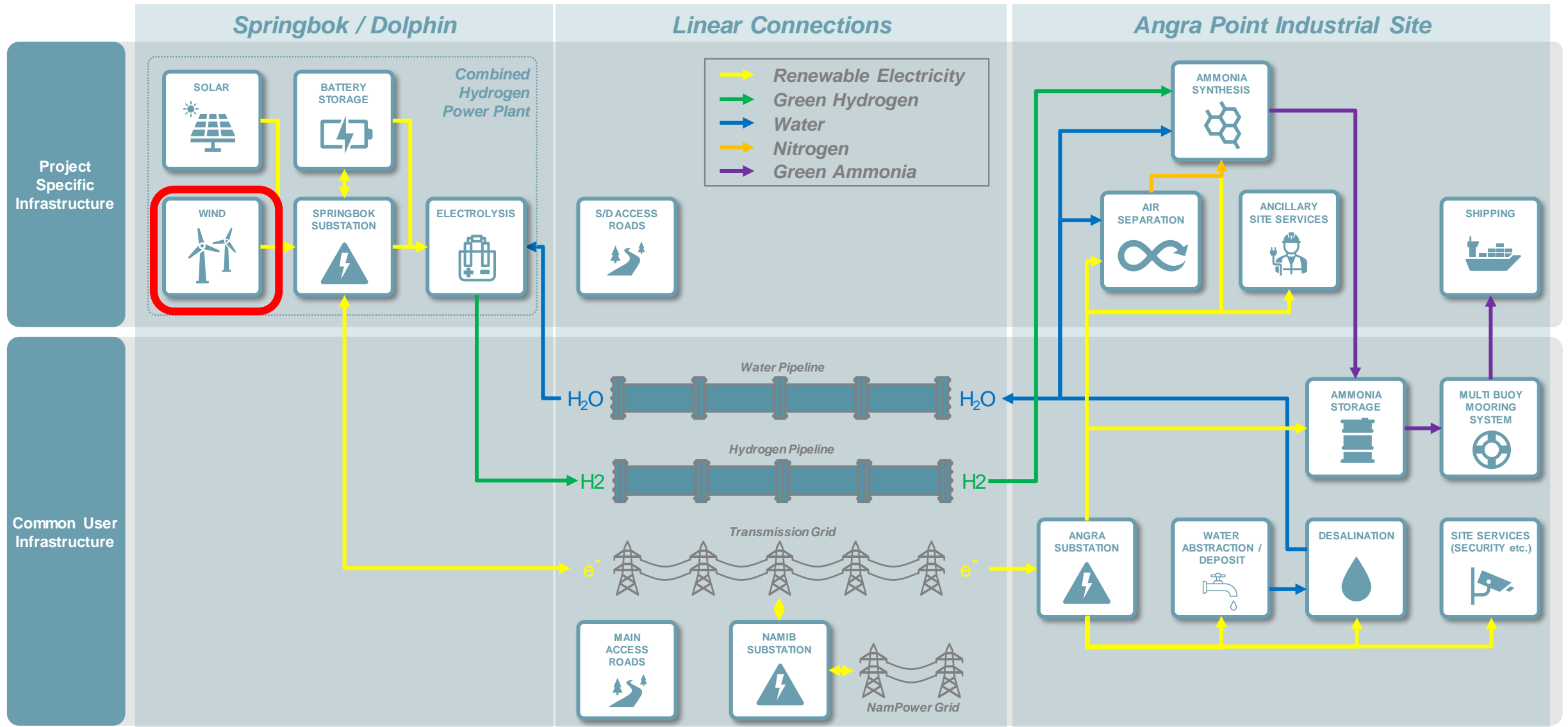
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Engineering workstreams and capacity

Engineering Deep Dive - Wind

# A deep dive into one part of the project



# A deep dive into one part of the project - Wind



*Phase one & two*

**Current Generation Assumption**

**3.5 to 4 GW Wind**



**Target number of Turbines**

**620 to 670 installed**

**Turbine type**

**5 to 8 MW units being considered**

**Turbine height**

**80 to 140m hub height being considered**

**Turbine abnormal Components (snap sample)**

**Blades: 87m, 30t  
Nacelle: 140t**

**What needs to happen?**

**Wind Data Measurement**

**Turbine siting**

**OEM & model selection**

**Civil works (roads, platforms)**

**Order and Manufacture**

**Foundations**

**Logistics**

**Crane & Installation**

# Montage

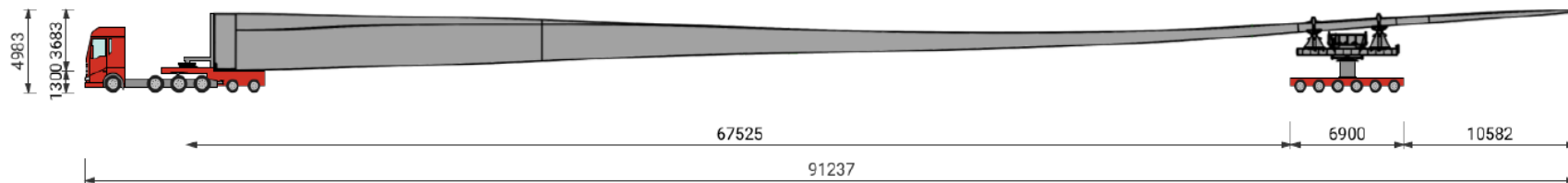
Summary of JB  
Scheepers's  
previous projects  
experience  
in Namibia

## Turbine siting



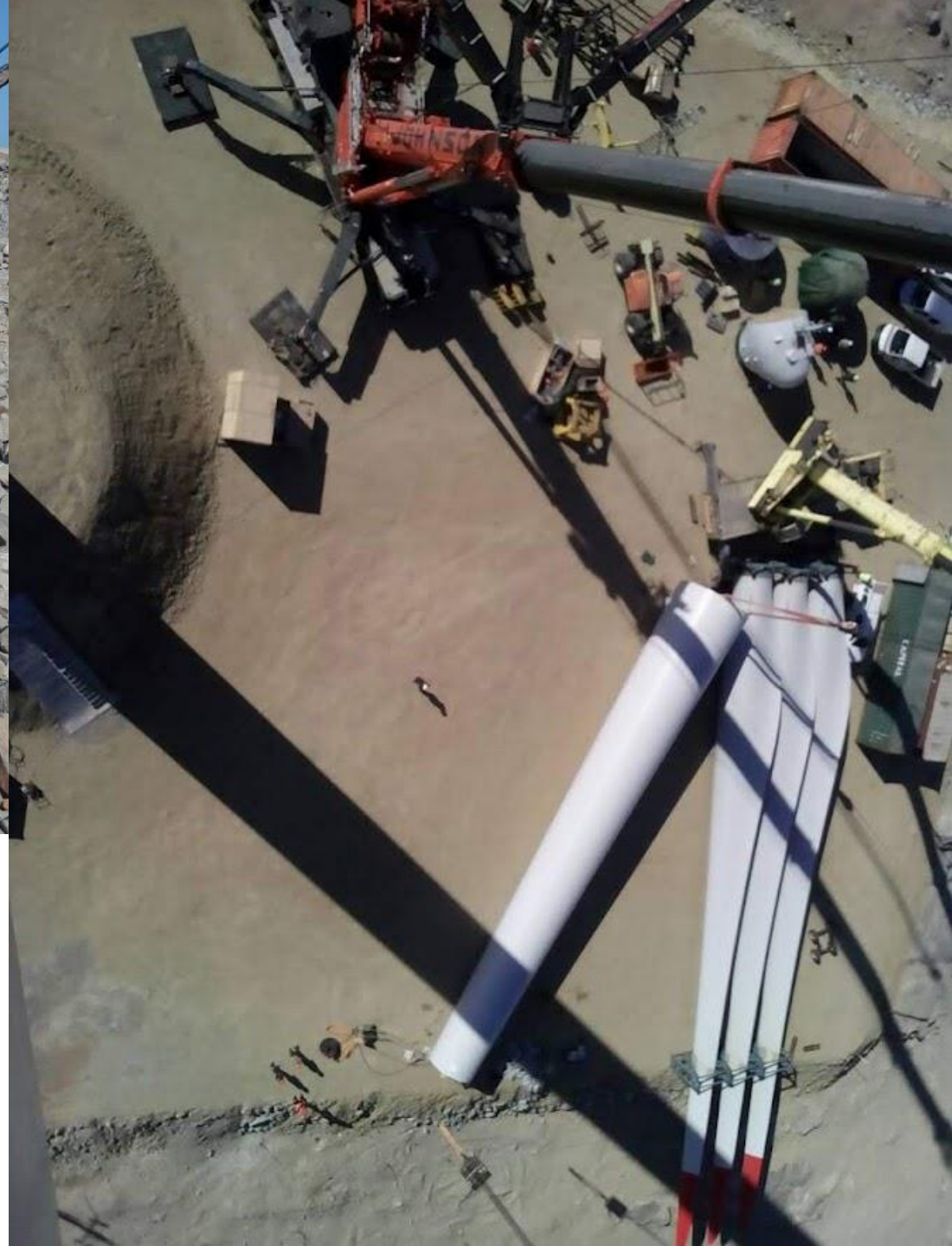


## Logistics





Civil works  
(roads, platforms)





## Foundations





# Crane & Installation



## A deep dive into one part of the project - Wind





## Construction & RE Industry Discussions

JB Scheepers will take part in an industry lead technical project work shop for in depth and detailed discussions. These workshops are a forum collaboration lead by the industry bodies:

- Construction Industry Federation
- Renewable Energy Industry Ass. of Nam

Deep dive discussion on the construction needs, latest configurations and industry co-solving for effective implementation, early planning.

Target Feb 2024.

