



We deliver, We innovate, We share

Offshore wind farm Hollandse Kust Noord innovations

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KIVI Engineering Society
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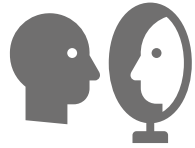
Agenda

- Introduction
- HSSE – CrossWind HSSE Journey
- Introduction to the CrossWind project and Innovations
- Baseload Power Hub process flow
- Key Packages – Battery Energy Storage System, Fuel Cell, Electrolyser
- Q&A

Safety Moment

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CrossWind's HSSE Journey: Partnering on Care



SAFE SPACE TO
REFLECT & LEARN



ACTIVELY
LISTEN & ENGAGE



ALWAYS
CONTRIBUTE &
CHALLENGE



Safety

Productivity

Collaboration

Innovation



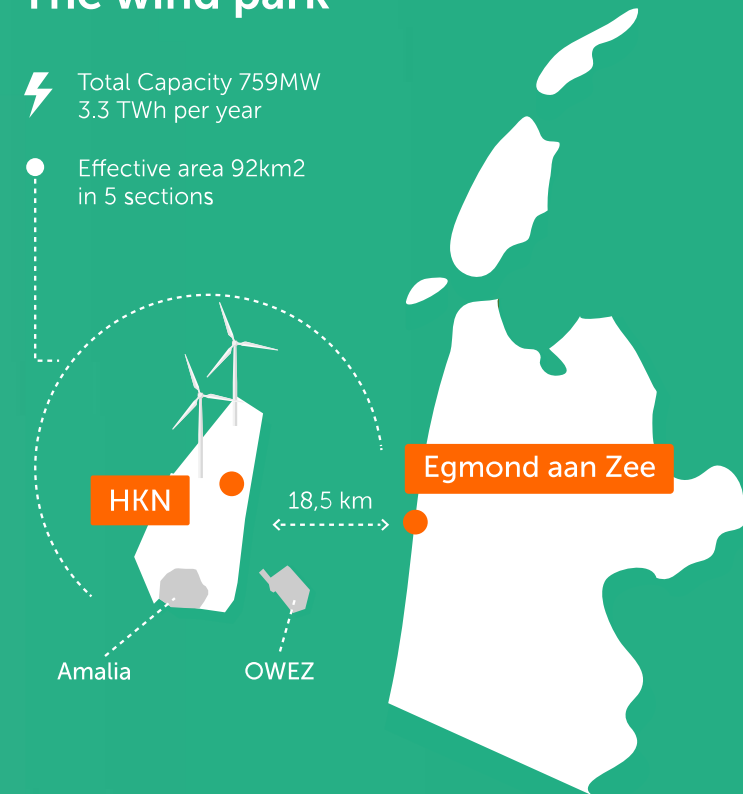
Project Description

- CrossWind – JV (Shell and Eneco)
- **We deliver, We Innovate, We Share**
- Hollandse Kust Noord (site V)
- North Sea, the Netherlands
- Effective Area 94km² (1 site with 5 sections)
- 22km from IJmuiden port
- 15-28m water depth + good soil conditions
- Windspeeds of 9.57m/s (at 100m MSL)
- Capacity 759MW + Production >3.3TWh/yr

The wind park

⚡ Total Capacity 759MW
3.3 TWh per year

• Effective area 92km²
in 5 sections



Project Schedule

- Permit awarded on 30 Jul 2020
- Grid available 31 Mar 2023 at TenneT HKN Platform (offshore)
- First power mid 2023
- 95% commissioned end 2023

Data available

[RVO HKN site](#) , [RVO HKN data](#) , [TenneT HKN information](#)

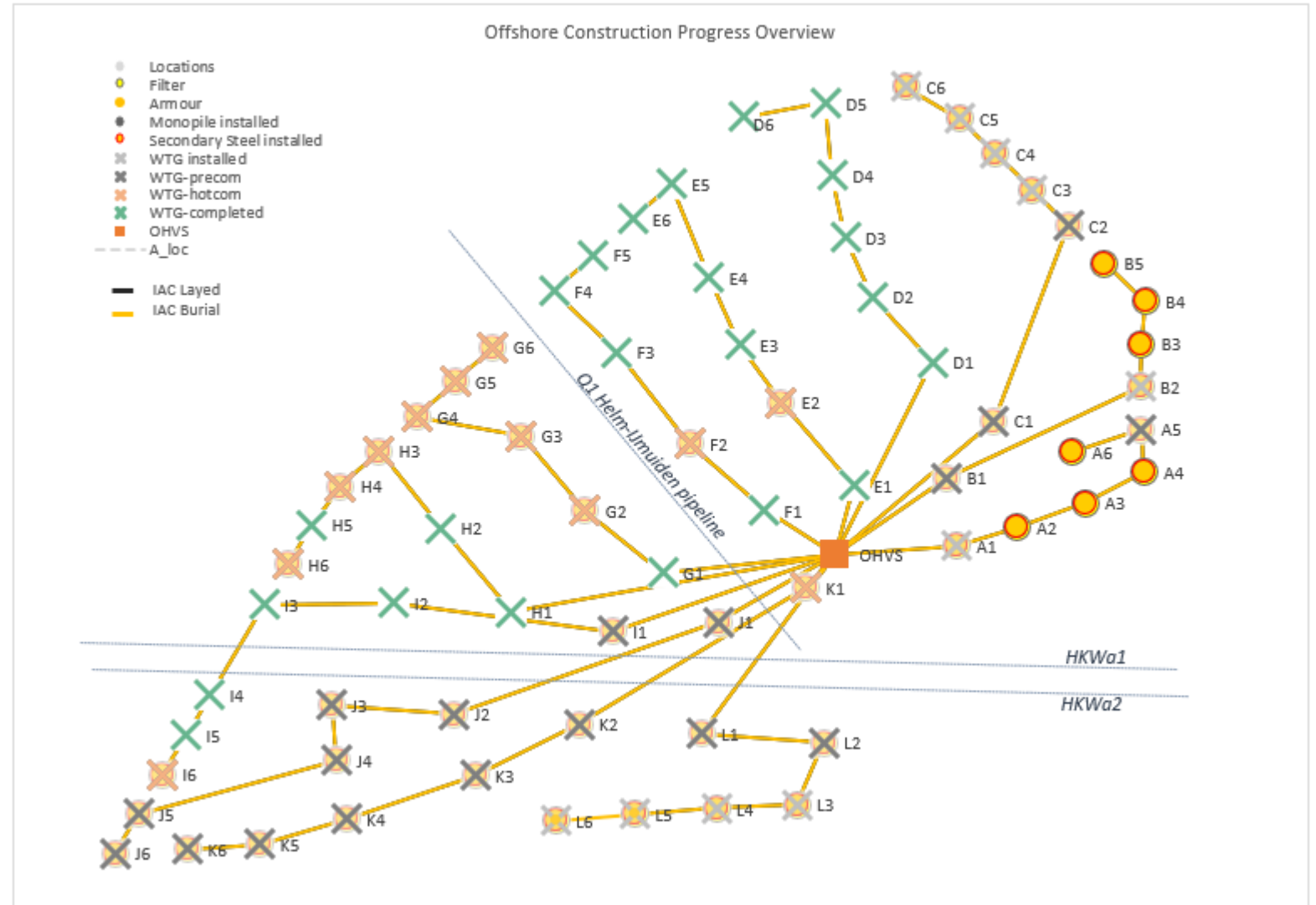
The turbines

 69 turbines



Construction Progress

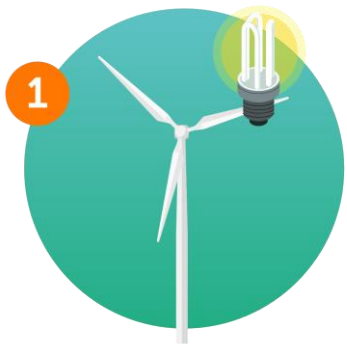
Item	Progress
Filter	70-70
Armour	70-70
Nature inclusive design	42-42
Monopile installation	70-70
Secondary steel	70-70
Cable laying	70-70
Cable buried	70-70
WTG installation	65-69
WTG pre-commissioning	60-69
Testing & Termination	50-69
String energisation	08-12
WTG hot-com finish	35-69 **
WTG trial run complete	35-69
WTG taken-over	23-69



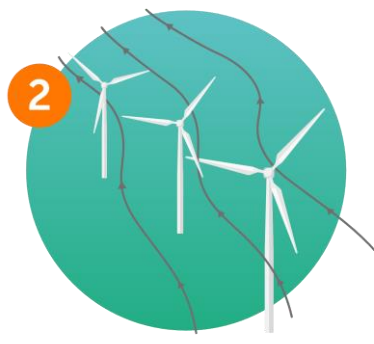
** 6 WTGs in hot com

An intelligent wind park

The wind doesn't always blow consistently. So how can a wind farm provide electricity when there is little wind? CrossWind and its partners are exploring five different innovations designed to address these challenges. Through these innovations, an offshore wind farm could be capable of providing more constant electricity regardless of the wind conditions.



Intelligent wind turbines



Addressing the wake effect



Floating solar energy



Storing energy offshore



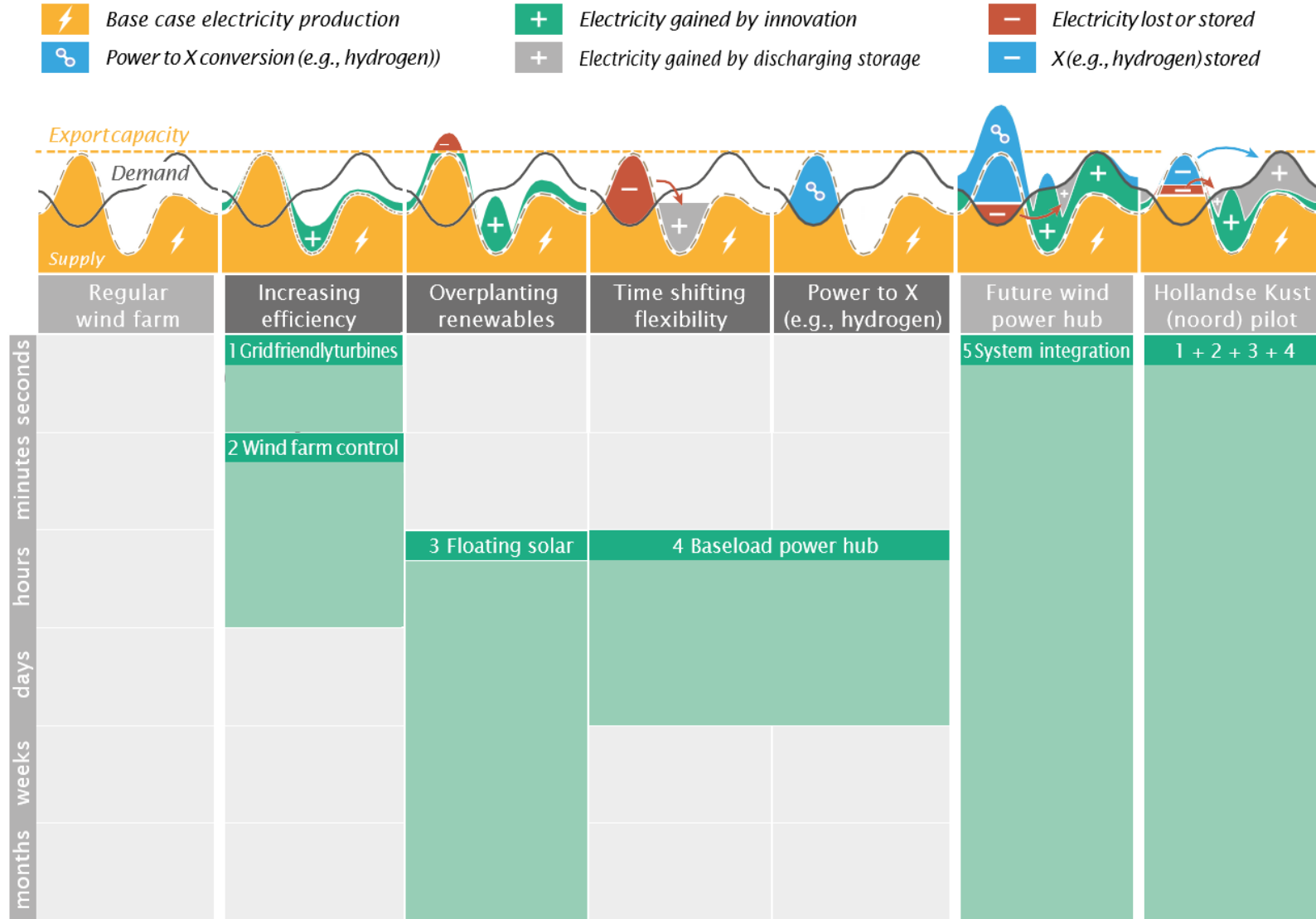
Research and integration

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Our innovations plan

- Committed to scope
- Increasing flexibility can be done at different time scales with different technologies

- Grid Friendly Turbines
- Advanced Wind Farm Control
- Floating Solar
- Baseload Power Hub
- System Integration



Highlights

Baseload Power Hub is technically feasible (also endorsed by the market)

CrossWind has no deviations from the HKN permit (and application) to date

CrossWind has completed FEED, has Key Package Vendors contracted [Statron (Battery Energy Storage System), Elogen (Electrolyser), Ballard (Fuel Cell)] and has contracted Rosetti Marino for the EPCI works of the Baseload Power Hub

CrossWind has an irrevocable permit from the government for the Baseload Power Hub

CrossWind is working on obtaining the permit for Floating Solar

CrossWind project is on schedule!

Base Load Power Hub

Highlights

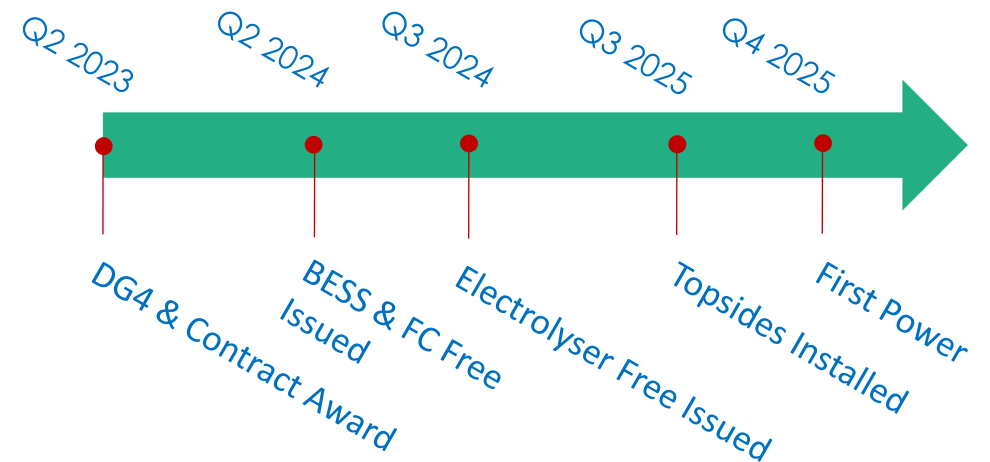
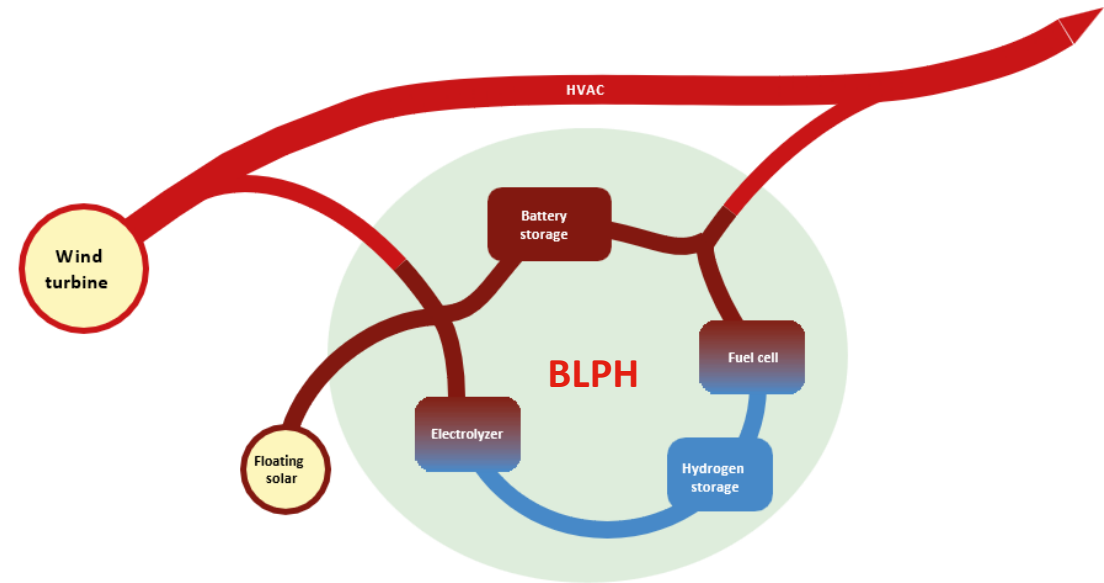
- Deliver at least 20% of the average electricity production of a WTG (i.e. 1 MW) 99% of the time independent of wind conditions, demonstrating time-shifting flexibility on hours-to-days resulting in reduction of intermittent power output.

Project Description

- Energy Storage platform to be installed within the CrossWind Wind Farm
- Unmanned Facility with maintenance visits every 6 months
- Operational in Q4 2025
- Demonstration period of 2 years
- Biggest Innovation Scope on CrossWind & World's First Deployment!

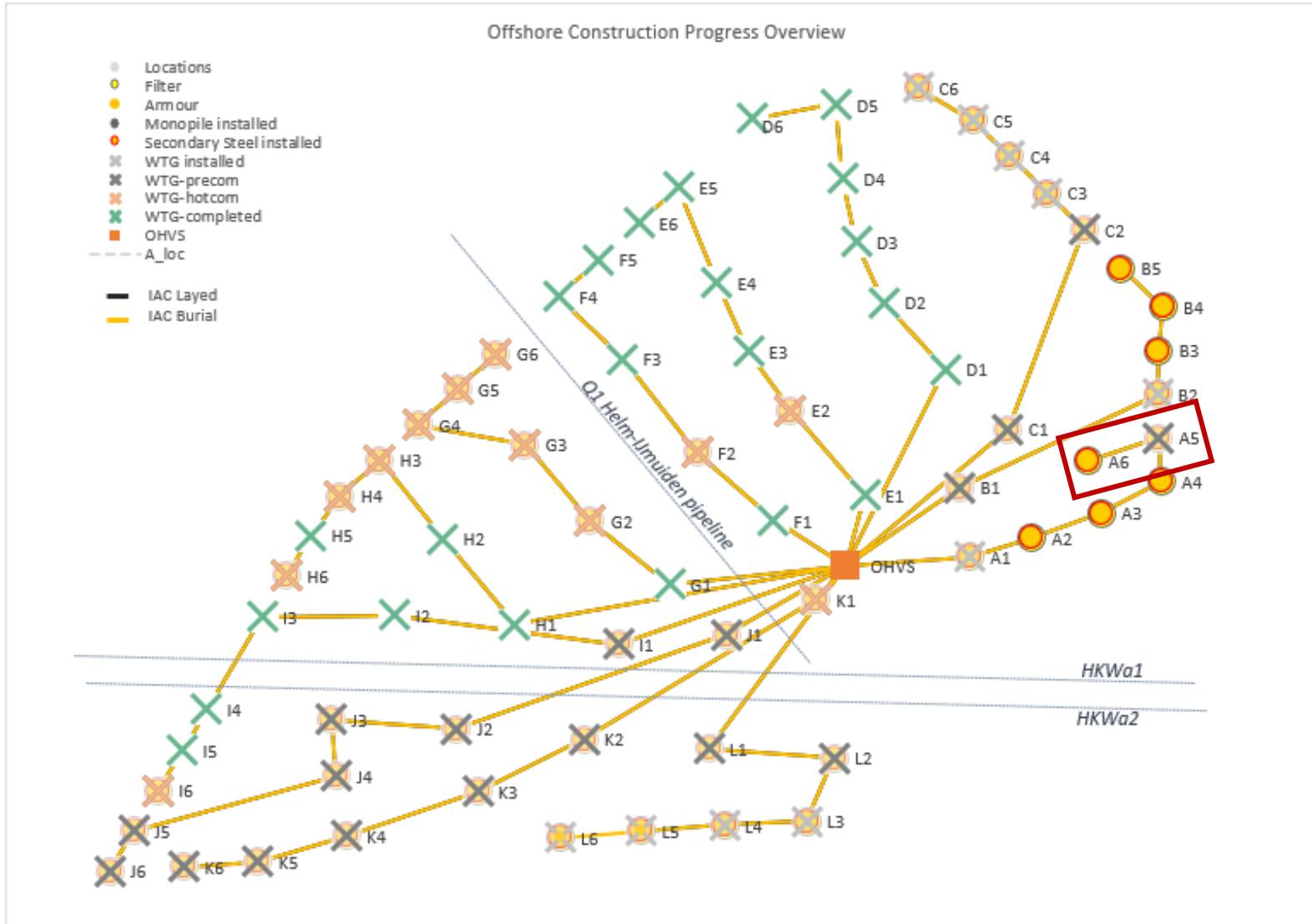
Technologies to be deployed:

- 1 MWe/5 MWh lithium-ion BESS
- 2.5 MW electrolyser
- 1,200 kg of 30-40 barg H2 gas storage
- 1.0 MWe fuel cell
- 0.5 MW Floating Solar

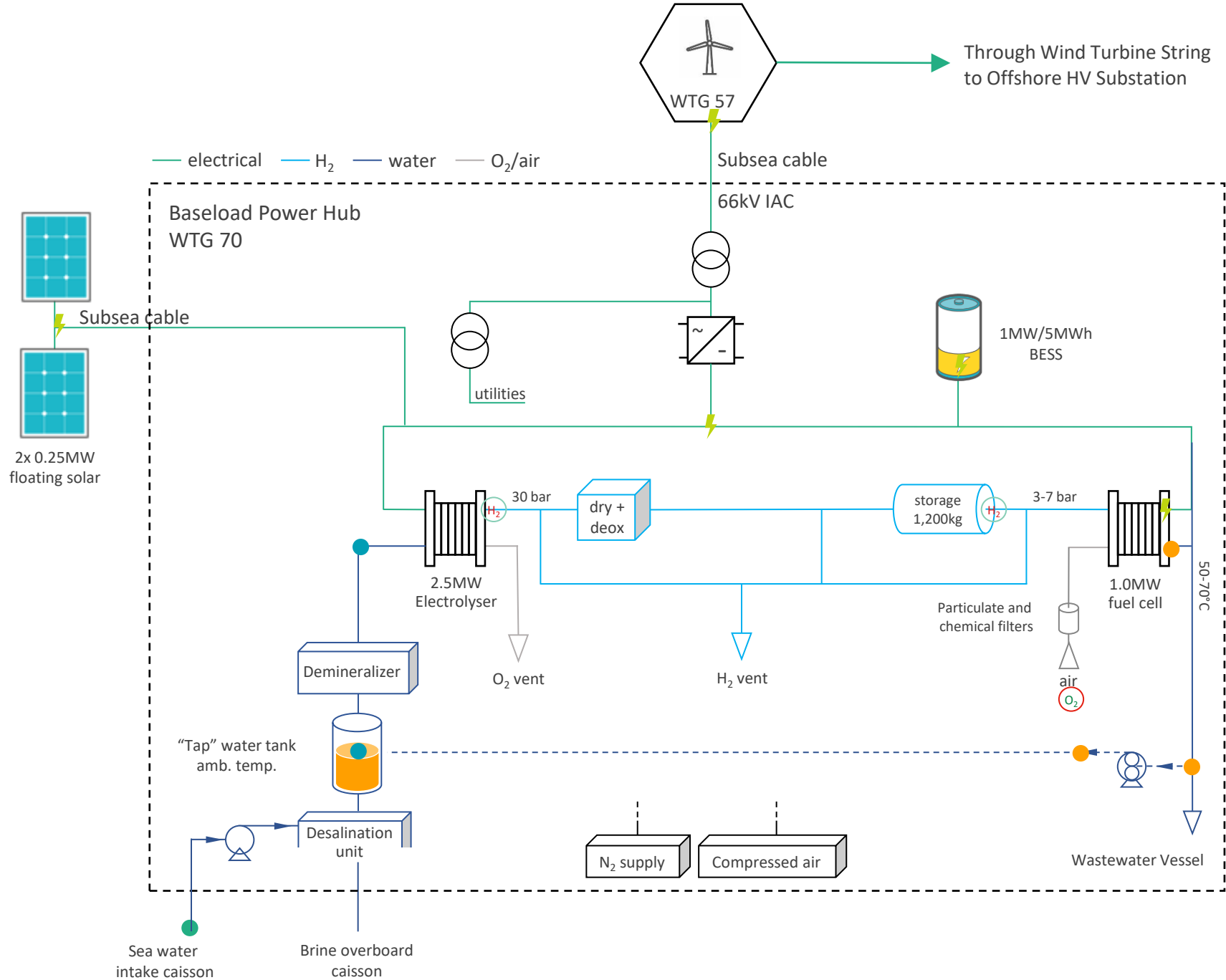


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Base Load Power Hub – What does it really mean?



- **BLPH** – Located at A6 within the Wind Park
- **Design Intent:** The combination of Wind Turbine A5 and BLPH A6 shall always deliver a minimum of 1MW
- **Power output of WT A5 shall dictate the mode of operation for the BLPH**
- **Main modes of operation**
 - **Charging (Excess power available)**
 - **Idle (Fully charged)**
 - **Discharging (WT less than 1MW)**

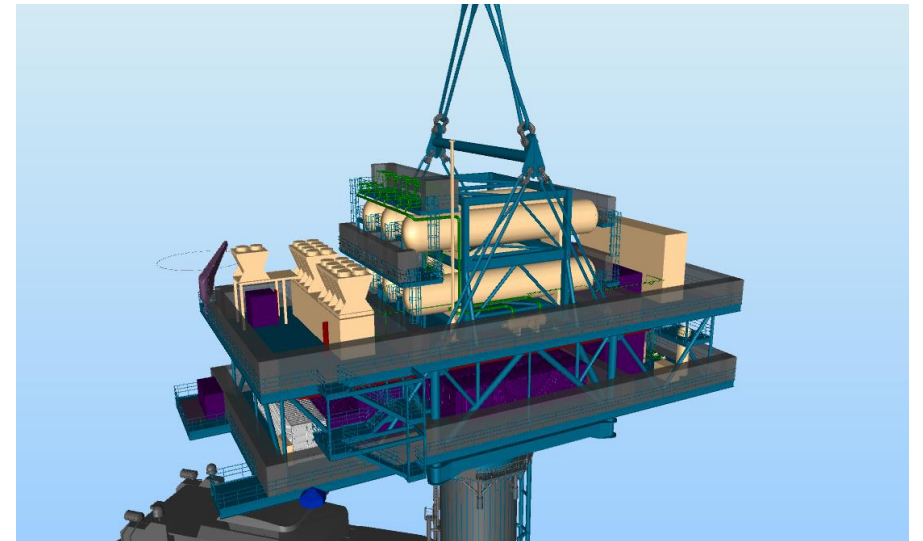
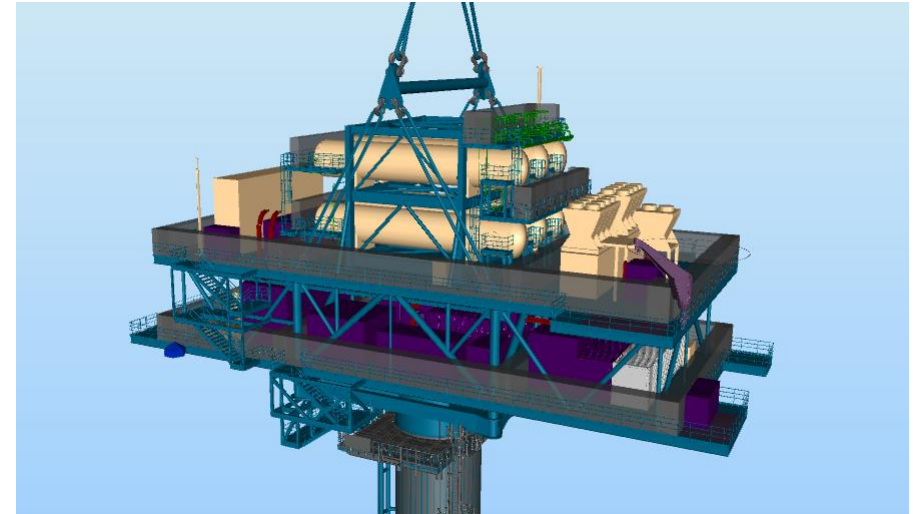


Base Load Power Hub

Key Features

- Topsides NTE weight = 2,400 Te
- Current dry weight estimate (gross): 1,636 Te
- Transition Piece (gross): 271 Te
- Structural steel weight (primary, secondary, tertiary for Topsides and Transition Piece) : 1,200 Te
- Two main deck levels
- Footprint: 19m x 41m
- Deck height: 6.5m
- Overall height (top of storage tanks): 20m
- Monopile preinstalled by in 2023 (interface frozen)

Project to be delivered by Rosetti Marino with Company Provided Items (Fuel Cell, Electrolyser, BESS)



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Battery Energy Storage System (1MWe)

Supplier: Statron - Freqcon

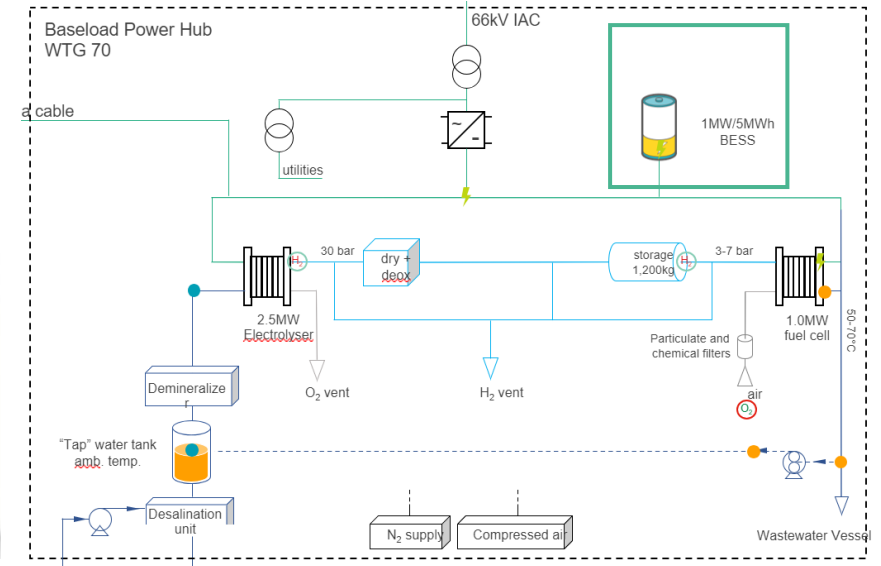
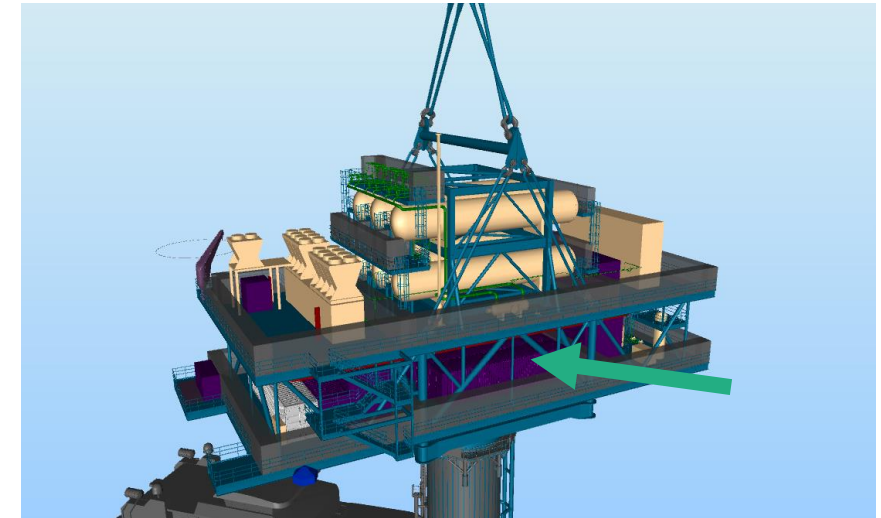
Technology: Lithium-Ion Battery Storage

Overview:

- Battery Storage Section: 2 x 40ft Containers - 35,000kg each
 - 11 racks/container
 - 28 modules/rack
 - 10 cells/module - 3080 cells/container - 6160 total
- Switchroom and PCS Section: 1 x 20ft Container - 15,000kg
 - Switchgear
 - UPS system
 - Rectifier
 - Transformer
- Ventilation and Cooling System

Delivery: Q2 2024

STATRON
NON STOP POWER



Electrolyser (2.5MW)

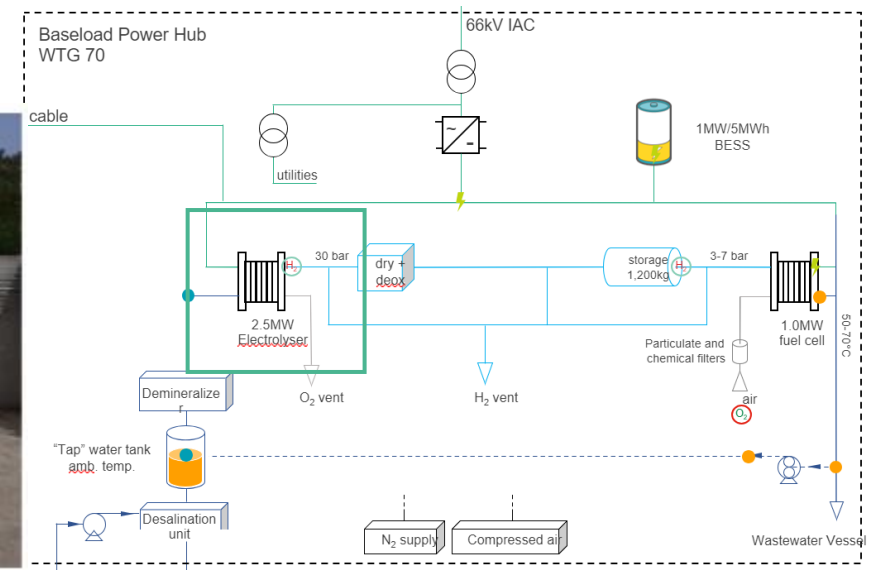
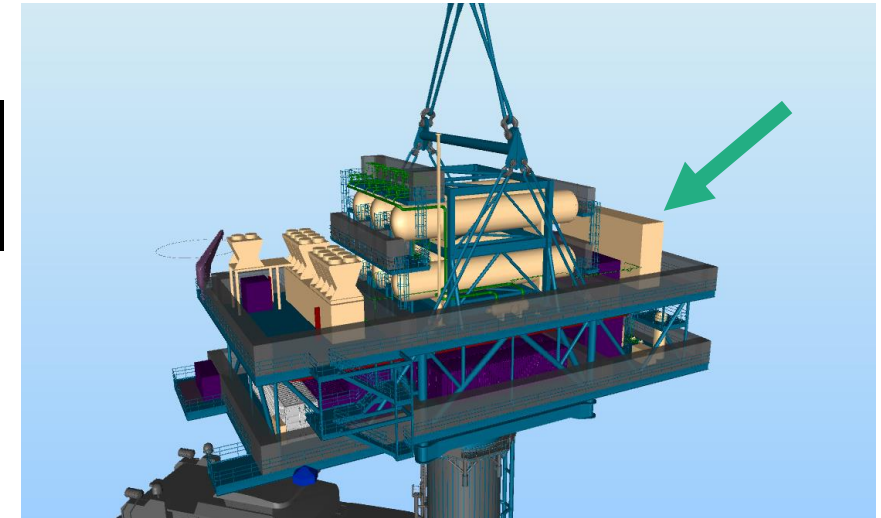
Supplier: Elogen

Technology: Proton Exchanger Membrane (PEM) Electrolyser

Overview:

- Section 1: 2 x 40ft Containers (stacked) - 48,000kg
 - Electrolyser Stacks
 - Process Skid
 - Hydrogen Purification Unit
- Section 2: 1 x 40ft Container
 - Water Purification System
 - Ventilation and Cooling system
- Transformer/Rectifier

Delivery: Q3 2024



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Fuel Cell (1MW)

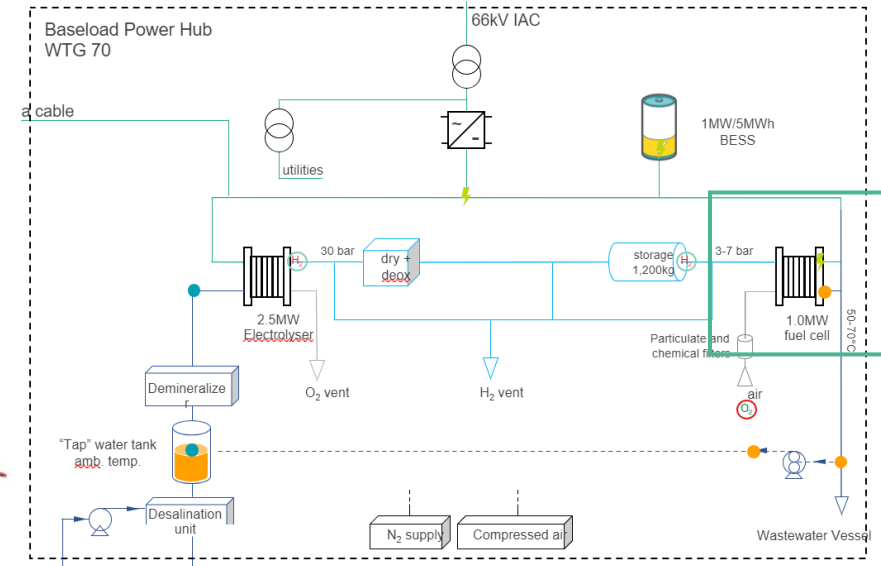
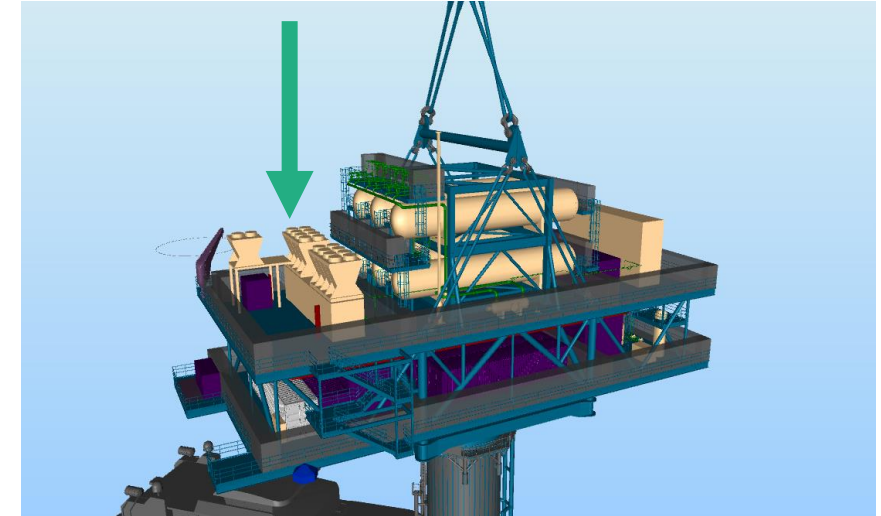
Supplier: Ballard

Technology: FCWave Fuel Cell

Overview:

- Section 1: 40ft container (22,000kg)
 - 6 x 200kW FCWave Fuel Cell Modules
 - Ventilation System
 - Hydrogen intake manifold
 - 8 x Electrical Cabinets (6 x DC/DC, 1 DC/AC, 1 x Control)
- Section 2: 10ft container (4,500kg)
 - 1250kVA Power Transformer
- Section 3: 1 x Cooling Platform (11,500kg)
 - 2 x HT Cooler + 2 x HT pumps
 - 1 x LT Cooler

Delivery: Q2 2024





Thank you!