Base Load Power Hub (BLPH)

Worksite WEF
(Work Execution Flow Scheme)

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No.	Description
1	
2	
3	
4	

Table of Contents

1. INTRODUCTION 4
1.1 Project Overview 4
1.2 Project Location 4
1.3 Project Concept 5

List of Figures

Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map 4
Figure 2 - Wind Park Details 5
Figure 3 – BLPH Concept 6

List of Tables

Not applicable

List of Attachments

Attachment 1 – Worksite WEF *(print format A0)*

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1. INTRODUCTION

1.1 Project Overview

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.2 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

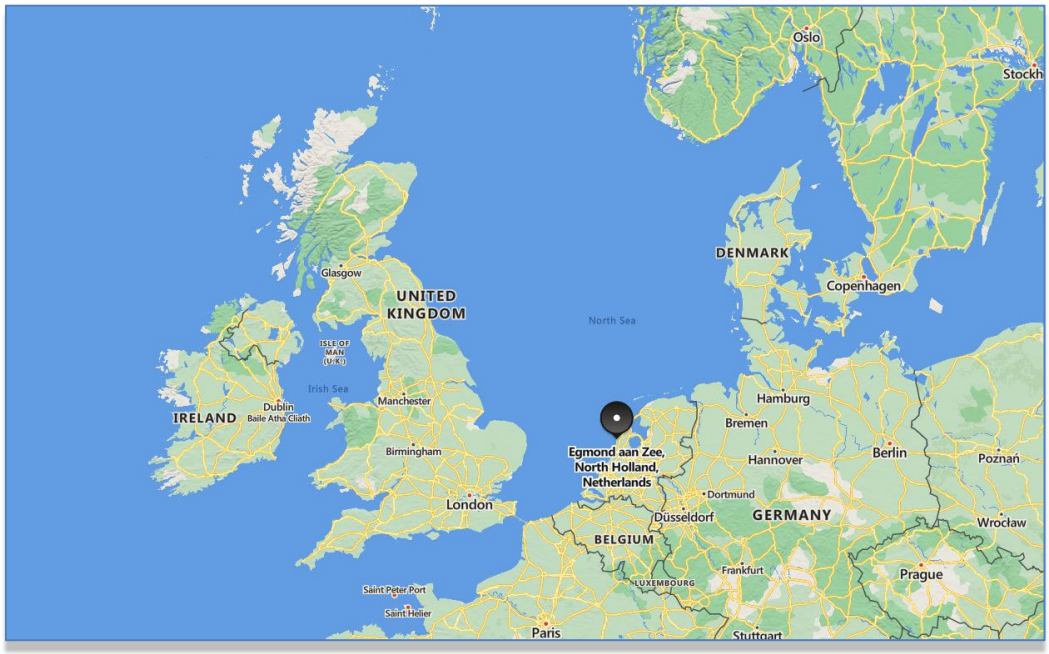


Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map

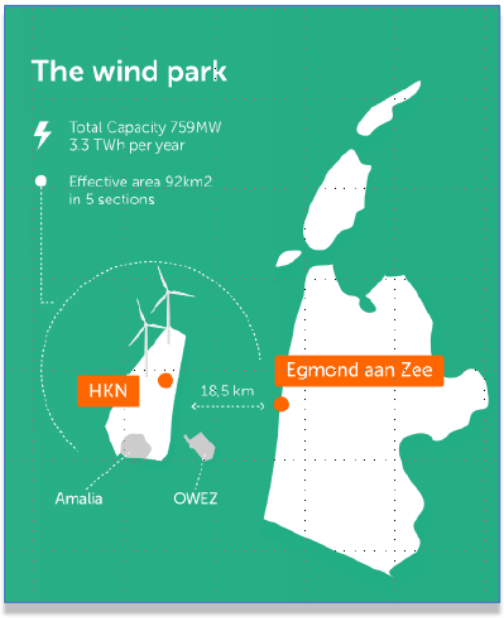


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile is located on coordinates E 590719.1, N 5841602.3 and is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.3 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

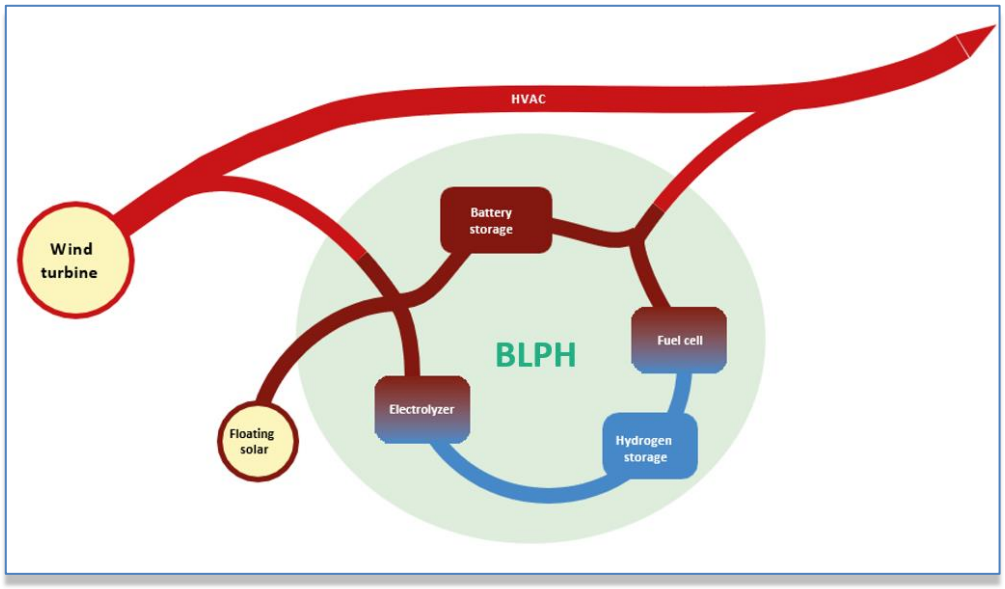
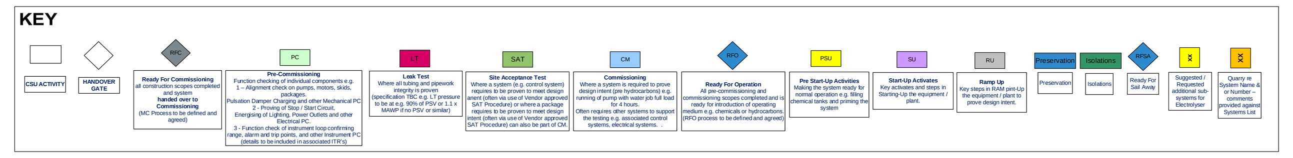



Figure 3 – BLPH Concept

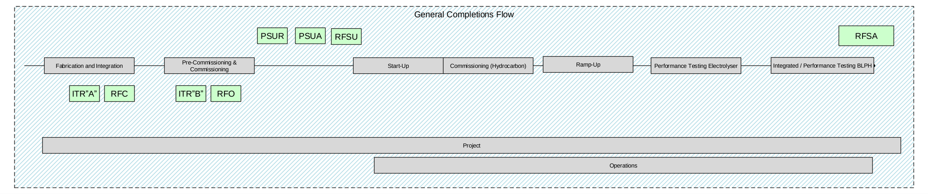
Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

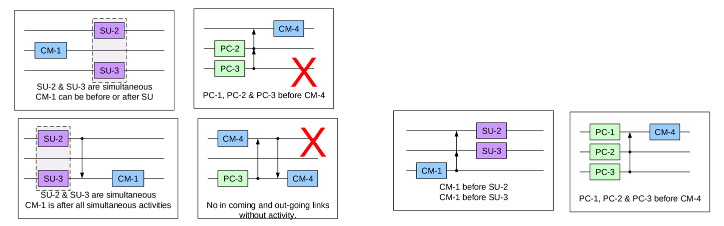
The purpose of the BLPH is to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

B.L.P.H PROJECT - YARD
WORK EXECUTION FLOW SCHEME (WEF)









NOTES

1	After discrete system scopes have been completed and tested Interface Testing across the systems to be carried out, as well as trip signal testing to / status signals from consumers such as Switchboards.
2	LT is shown on the respective swim lane where we expect leak testing is required. Details TBC at later date to confirm exactly how many Leak Test Packs will be required to be produced by the specialist contractor have been appointed and are able to review the P&IDs for system / spec breaks.
3	These systems combined make up the Water Treatment Package.
4	Completion of Cause & Effect Testing required to allow final sections of SAT's and relating RFO's to be signed off.
5	During this time the hydrogen will be routed to each vessel in turn (to fill) displacing the N2 and proving vessels each operate as expected.
6	This is the Mode Select Testing, detailed steps will be written in the OTP Onshore Performance & Integrated Test Procedure – estimated duration of 28 days. See plan excerpt with information that was available at the time – to be revised and updated once engineering complete.

Integrated Test		22d	22d	02-Apr-25	02-May-25
COMM-ON1430	Mode 1 - Charging (WF + Solar Farm)	3d	3d	02-Apr-25	04-Apr-25
COMM-ON1440	Mode 2 - Hot Stand-By Mode	1d	1d	07-Apr-25	07-Apr-25
COMM-ON1450	Mode 3 - Discharging Mode	2d	2d	08-Apr-25	09-Apr-25
COMM-ON1460	Mode 1 - Charging - (To Test the Emergency Mode)	2d	2d	10-Apr-25	11-Apr-25
COMM-ON1470	Mode 4 - Cold Stand-By Mode	1d	1d	14-Apr-25	14-Apr-25
COMM-ON1480	Mode 6 - Maintenance Access Mode	1d	1d	15-Apr-25	15-Apr-25
COMM-ON1490	Mode 4A - Emergency Mode (By Mean Of the Load Bank)	3d	3d	16-Apr-25	18-Apr-25
COMM-ON1500	Mode 5 - Black Out (Included Black Start)	1d	1d	22-Apr-25	22-Apr-25
COMM-ON1510	Reliability Run Test	5d	5d	23-Apr-25	29-Apr-25
COMM-ON1520	Mode 1 - Charging (To Recharge the BESS)	1d	1d	30-Apr-25	30-Apr-25
COMM-ON2010	Onshore Integrated Test Completed	0d	0d	02-May-25	

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Sheet 7 of 7

CROSSWIND | ROSETTI MARINO

Date	Revision	Description	Made by	Checked by	Approved by
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