BRIDGEND PERMIT APPLICATION

Supporting Information

HyBont Limited

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Prepared by:

RPS

Joanna Bruce
Environmental Consultant

20 Farringdon Street
London, EC4A 4AB

T +44 20 3691 0500
E joanna.bruce@rps.tetratech.com

Prepared for:

HyBont Limited

NON TECHNICAL SUMMARY

This application is for a low impact environmental permit for a Green Hydrogen Production Facility on land south of Attlee Street, Brynmenyn Industrial Estate, Brynmenyn, Bridgend CF32 9TQ. The site will be operated by HyBont Limited.

The site will comprise a hydrogen production facility with electrolysers that generate green hydrogen from electrical power by splitting water, hydrogen storage, and a hydrogen refuelling station. The power supply for the hydrogen production is intended to be supplied from renewable wind and solar generation; wind power via the grid, and solar power through directly connected Solar PV Array.

The site will benefit from an Environmental Management System which details the equipment maintenance, accident prevention, complaints procedures, staff competency and training requirements.

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1 INTRODUCTION

1.1.1 HyBont Limited is proposing to develop a green hydrogen production facility on land south of Attlee Street, Brynmenyn Industrial Estate, Brynmenyn, Bridgend CF32 9TQ. The production of hydrogen falls under Schedule 1, Part 2, Section 4.2 a(i) of the Environmental Permitting Regulations and consequently will require permit to operate from Natural Resources Wales (NRW).

1.1.2 This document and its appendices form the application to NRW for a permit for the green hydrogen production facility.

1.2 Background

1.2.1 The proposed project at Brynmenyn, Bridgend comprises of a hydrogen production facility with electrolysers that generate green hydrogen from electrical power by splitting water. The site also consists of onsite hydrogen storage, a hydrogen refuelling station and a tube trailer loading facility with tube trailers for offtake. The nature of the proposed facility and its expected impacts are considered to meet 'low impact' criteria. Therefore, standard rules SR2009 No2 Low impact Part A Installation permit is considered appropriate for the green hydrogen production facility.

1.2.2 A pre-app was submitted to NRW dated 09/06/23 outlining the justification for low impact, however NRW advised that this could not be assessed at the pre-application stage as it was considered pre-determining the application.

1.2.3 Screening for designated sites indicates Blackmill Woodlands SSSI and SAC is located 1,500 m NE of the site. Cefn Cribwr Grasslands SSSI and SAC is located 3900 m SW of the proposed hydrogen site. There are no sensitive ecological receptors within 1 km of the site and therefore meet the standard rules requirement for proximity to sensitive ecological receptors.

1.2.4 The justification for how this Site meets low impact criteria is included in Appendix E.

1.3 Site Location

1.3.1 The green hydrogen production facility will be located on cleared land located to the southeast of Brynmenyn Industrial Estate. The site is currently owned by Bridgend Borough Council BCBC. The National Grid Ref is SS910843.

1.3.2 A site location plan showing the proposed permit boundary is provided as Drawing 1. The permitted area of the site is approximately 1.0 ha.

1.3.3 The surrounding land is occupied by industrial land use immediately to the north west, and residential land use to the east. The closest residential properties are located approximately 50 m to the east of the site, east of the A4065.

1.3.4 There will be no direct discharge of aqueous waste within 10km upstream of a European Site, or a SSSI; within 100 metres upstream of a National Nature Reserve, Local Nature Reserve or Ancient Woodland; or within a National Park.

1.4 Operator Details

1.1 The Operator of the proposed green hydrogen production facility will be HyBont Limited.

1.5 Structure of the Permit Application

1.5.1 This section provides an overview of the proposals. This is supplemented by further details in Sections 2 – 4 as follows:

- Section 2 provides an overview of the activities on site;
- Section 3 summarises the management systems in place;
- Section 4 addresses the environmental risk and effects

1.5.2 Supporting documents, assessments and application forms are provided within the appendices list as set out in the contents page.

2 OPERATIONS

2.1 Overview

2.1.1 The proposed green hydrogen production facility will have a rated capacity of circa 7.5 MWe, consisting of multiple (expected to be 3) electrolyser modules producing circa 700 tonnes per annum of hydrogen. Each module will be up to 2.5MWe. There will be a demand for other equipment, such as compressors, which will use an additional 500 kWe, increasing the average electrical use to circa 8 MWe total.

2.1.2 The green hydrogen production facility will comprise electrolysers to generate hydrogen, hydrogen storage, and a hydrogen refuelling station. Storage for up to 4.99 tonnes of hydrogen will be provided. A process flow diagram is included in Drawing 4.

2.1.3 The power supply for the hydrogen production is intended to be supplied from renewable wind and solar generation; wind power via the grid, and solar power through directly connected Solar PV Array.

2.1.4 The hydrogen supply of circa. 700 tonnes per year would be expected to indicatively fuel HGV's, buses, and tube trailers.

2.1.5 The green hydrogen production facility site will be approximately 1 hectare in size, of which a large proportion will be used for roads and paving to allow adequate access for re-fuelling of heavy vehicles including an outer perimeter road, and the remainder for an 'island' of hydrogen production, storage, vehicle re-fuelling equipment and tube trailer loading.

2.2 Raw Material Handling and Management

2.2.1 The green hydrogen production facility utilises few raw materials. The key raw materials, expected consumption and storage arrangements are summarised in Table 2-1 below:

Table 2-1: Raw Materials

Raw material	Use of Raw Material	Annual Consumption	Storage
Towns water	To supply electrolysers	29,300 te/yr at 100% capacity factor	Storage tank, net capacity 7m^3
Water	To supply firewater storage tank	N/A	Storage tank, net capacity 45m^3
Nitrogen	Used for maintenance shutdown only	Variable usage depending on maintenance requirements	Storage tank. 18.6 Nm^3

2.2.2 Of the materials above, water used within the electrolysers to generate hydrogen is the primary raw material.

2.3 Water Treatment Plant

2.3.1 Water from the Welsh Water mains supply will be delivered by pipe to the facility. The hydrogen generation stage requires high quality water and therefore the mains water will be treated within a reverse osmosis unit. Treated water is stored within the towns water storage tanks within respective electrolysers.

2.4 Electrolysis

2.4.1 The proposed electrolysers will have a combined rated capacity of circa 7.5 MWe. It will be based on a modular containerised solution comprising of 3 proton exchange membrane (PEM) electrolysers each of 2.5 MWe capacity. Each electrolyser container is approximately 12 m x 2.5 m x 3 m (comprised of standard 40ft ISO-container). A roof mounted cooling system comprising two stacked containers extends the height to approximately 6 m. There is also a hydrogen vent which extends 5.3 m above the top of the electrolyser unit.

2.4.2 A separate power supply enclosure is required to manage the electrical power supply to the electrolysers.

2.4.3 Each electrolyser will be supplied with water from the towns water storage tank to the anode. An electrical current is used to electrochemically split hydrogen and oxygen in the towns water supply.

2.4.4 Electricity will be sourced entirely from renewables. Details on the solar and wind renewable energy source are outlined below:

- Electricity source modelling has been carried out based on the principles:
    - Power from the private wire solar PV will be consumed as a priority. 100% of the generated output of the solar will be consumed.
    - Remaining power will be sourced via a wind sleeved PPA on a Pay as Produced contract. The HyBont site will consume power from the wind site where there is demand or there is available storage capacity to produce hydrogen. Where there is no demand or storage capacity, then surplus wind power will be traded to the market through supply agreement with Smartest Energy.
    - Any additional power required on top of the above electricity sources will be provided by Smartest Energy under supply agreement. Power will be sourced from their existing portfolio of renewable assets and will be renewable energy guarantees of origin (REGO) backed with temporal correlation and directly contracted with the generator.
- The split of electricity sources has been modelled with the principles set out above. Supply split and status is summarised below:
    - Solar PV - 13% of total electricity demand with annual yield of 5,457 MWh per annum.
    - Wind Sleeved PPA (Upper Ogmore Windfarm) - 61% of total electricity demand with power purchased volume of 25,183 MWh. Upper Ogmore Wind Farm has a total capacity of 25.2 MW with planning consent and grid offer accepted. Marubeni are owners of the Upper Ogmore Wind Farm site and plan to use a percentage of the generated output to supply the described power to HyBont. HyBont will have access to Upper Ogmore meter data in order to confirm that generation and hydrogen production are matched (Temporal Correlation) and associated REGOs will be supplied with power.
    - Smartest Energy - top up power - 26% of total electricity demand with volume of 10,765 MWh per annum to be supplied from Smartest Energy, an energy supplier to the commercial and industrial space with a large portfolio of renewable energy.
    - Total electricity demand is expected to be circa 41,500 MWh per annum.

2.4.5 In each of the PEM electrolysers, the membrane acts as a solid ion conducting electrolyte. The membrane allows the H+ ion to transfer from the anode side of the membrane to the cathode site where it combines with electrons to form hydrogen.

2.4.6 The reactions taking place at the anode and cathode in the PEM electrolysers are:

Anode: $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

Cathode: $4H^+ + 4e^- \rightarrow 2H_2$

Overall: $H_2O \rightarrow H_2 + 0.5O_2$

2.5 Cooling

2.5.1 The electrolysis process generates heat and therefore cooling is required. Cooling to the electrolysers will be provided using a fin-fan air cooling system. Three fin-fan coolers will be provided, one serving each of the three electrolyser units.

2.6 Hydrogen Conditioning and Compression

2.6.1 Hydrogen produced in the electrolysers requires conditioning to remove moisture. The hydrogen conditioning plant will comprise dehydration using molsieve/desiccant.

2.6.2 Hydrogen is discharged from the electrolysers at a pressure of 30 bar. It is then compressed within 2 reciprocating compressor sets raising the pressure from 30 bar to 100 bar. The second set of compressors increases the hydrogen from 100 bar to 300 bar. The final set of compressors raises the pressure from 300 bar to 500 bar.

2.7 Hydrogen Storage and Supply

2.7.1 Hydrogen will be stored at a pressure of 500 bar. The site will hold no more than 4.99 tonnes of hydrogen.

2.7.2 Hydrogen will be stored in Type 1 storage vessels, 12 m long fixed tubes. Storage for up to 1.5 tonnes of hydrogen will be provided in six separate banks, each bank with 5-6 tubes for approx. 250kg per bank.

2.7.3 Hydrogen will be dispensed from the site either by:

- Tube-trailers
- Vehicle fuel dispensing

2.7.4 Tube-trailers will be used to distribute hydrogen to consumers. Hydrogen will be loaded into hydrogen tube-trailers using the tube-trailer loading bay adjacent to the hydrogen storage area of the HPF with an expected fill rate of 125.8 kg/hr. The tube-trailers will each have a maximum capacity of up to 1,100 kg/H2/trailer (up to 34 cubic metres) at 500bar. Tube trailer filling is anticipated to be carried out daily with typical fill times of circa 8 hours per trailer. Tube-trailer movements shall be controlled to ensure total quantity of hydrogen on site does not exceed 4.99 tonnes.

2.7.5 The hydrogen refuelling station will be fed from the 500 bar fixed storage units. Hydrogen is let-down from the fixed storage pressure for supply to the refuelling station. The refuelling facility will comprise of 3 hydrogen vehicle dispenser bays suitable for refuelling hydrogen vehicles (buses and HGVs) predominantly at 350 bar and at a rate up to 216 kg/hr. The Hydrogen Refuelling Dispenser bays will be located adjacent to both the Hydrogen Production area and the Hydrogen Storage areas of the facility.

2.8 Hydrogen Venting

2.8.1 Under certain emergency conditions there may be a need to vent hydrogen. The vent will be designed to provide safe dispersion of hydrogen to atmosphere and is expected to extend 5.3 m above the top of the electrolyser unit, 11.35 m from the ground.

2.8.2

2.8.3 It is noted that flaring has the potential of reducing global warming impacts from the venting of hydrogen. Flaring is better suited for larger facilities and has been discounted on the basis that the hydrogen production facility itself is very small and venting is more suitable at this scale.

2.9 Management of Oxygen Byproduct

2.9.1 Oxygen collected from the anode is discharged to atmosphere via a stack with a discharge point 6.7m above the ground. The stack will be designed to ensure safe dispersion of oxygen.

2.10 Control System

2.10.1 The control system shall be based upon a central distributed control system (DCS), which will interface with each of the package system controllers.

2.10.2 The control system will gather all available data (which shall be stored in a historian). The data will be used to provide 'fully automated control' upon the manual selection of particular operating requirements (i.e. selection of specific HV Power Supplies, whether to provide hydrogen to storage, which will then be actioned automatically by the DCS.

2.11 Waste Generation

2.11.1 The only waste produced on site will be aqueous waste from the onsite water treatment process. This aqueous waste stream has up to 4x concentrated mineral content and will be discharged to sewer under a Trade Effluent Consent without further treatment. The average daily wastewater discharge is 16.7 m^3, and the maximum daily wastewater discharge is 27.82 m^3/d.

2.11.2 Routinely solid waste production on site is low. The main wastes produced are associated with periodic replacement of plant items:

- Spent DeOxo Catalyst - no storage on site. Removed and replaced as necessary.
- Oily Water - overflow product of Oily Water Treatment. To be removed by vacuum truck as necessary.

2.11.3 The reverse osmosis membranes will be replaced every 3- 5 years.

2.12 Energy Efficiency

2.12.1 The hydrogen production facility will have a rated capacity of circa 7.5 MWe. There will be a demand for other equipment, such as compressors, which will use an additional 500 kW, increasing the average rated capacity to circa 8 MWe total at start of life. Note that at end of life before replacement (approximately every 8 years), a maximum of 10% additional power will be required by the electrolyser stack.

2.12.2 Electrical power shall be provided at 11kV AC 50 Hz 3-phase from a distribution network operator (DNO) supply and a solar generation supply at the HV substation. This supply shall include the capability to source power from grid (including renewable wind generation) and solar generation through a directly connected Solar PV Array at Bryncethinvia a 1.2km fully underground private wire connection.

2.12.3 An uninterruptible power supply (UPS) system will be provided to back-up the site control and emergency systems and will comprise batteries to enable safe shutdown of the facility. Provision for connection of a LV back-up generator will be made on the main LV switchboard, to provide the emergency auxiliary power load in the event of a site shutdown.

2.12.4 No combustion sources are involved in this wind energy usage. For further details on solar and wind energy renewable sources see Appendix E.

3 MANAGEMENT

3.1 Management Systems

3.1.1 A site-specific Environmental Management System (EMS) will be produced and put in place prior to commissioning of the site.

3.1.2 The EMS will detail the procedures for environmental management on site to minimise the environmental risk from the activities covered by the permit, albeit the environmental risk of this facility is considered low.

3.1.3 All staff and external contractors shall be given information on the requirements of the EMS as part of the induction training and a copy will be made available on site.

3.1.4 A copy of the EMS shall be kept at the site for use by staff when required.

3.2 Site and Equipment Maintenance

3.2.1 Management systems will be put in place to ensure that the facility is operated as designed. These systems will not only cover normal running but will also address abnormal operation and start-up and shutdown of the facility.

3.2.2 Planned maintenance routines will be established to ensure all key plant components which have the potential to affect the environmental performance of the facility remain in good working order.

3.2.3 Maintenance routines will draw on manufacturer's recommendations, modified as appropriate by operational experience during the lifetime of the facility. The operator will undertake long term maintenance and ensure that all plant and equipment is maintained to the manufacturer's or supplier's recommendations. Routine maintenance will be undertaken by HyBont Ltd engineers.

3.3 Accident Prevention and Management Plan

3.3.1 The EMS will contain an accident management plan.

3.3.2 The plan will identify potential incidents that could have an environmental impact, the cause and consequences; measures taken to avoid the accident happening and actions to minimise the impact on the environment from the accident. It shall include details of how accidents shall be reported, investigated and what the response shall be.

3.3.3 Emergency response facilities will be made available on site to deal with any such incidents should they occur.

3.3.4 In the event of an accident on site, HyBont will undertake investigations in order to resolve the issue and/or report the accident to emergency services and NRW, as required.

3.3.5 After the immediate actions have been undertaken to resolve the accidence a non-conformance report shall be completed along with a health, safety and environment report. This shall be reviewed by HyBont's health safety and environment committee, and safety measured will be implemented.

3.4 Complaints Procedure

3.4.1 A complaints procedure will be in place as part of the EMS.

3.4.2 A complaint report will be completed by HyBont for any complaint received at the site. This will be reviewed to decide if any corrective action is required.

3.4.3 If required the operator will send a service technician to site to resolve the issue.

3.5 Staff Competence and Training

3.5.1 Staff operating the plant or providing onsite maintenance will be sufficiently trained to ensure that they are technically competent undertake their role. The HyBont staff required to interact with the plant, specifically in an emergency situation, will also be sufficiently trained to ensure they are technically competent. HyBont technical specialists will be available at all times to advise as required.

3.5.2 All staff, contractors will receive training on the EMS requirements as part of their induction, this will include environmental awareness including awareness of the environmental permit.

3.5.3 Copies of relevant plans, procedures and the environmental permit shall be kept at the site for reference.

3.5.4 Job specifications are defined within the EMS and include details on relevant qualifications and training (including where relevant, on the job training) required for that role. As a minimum, records will include details relating to the date, type of training and training provider. Records shall be available for inspection as required.

3.5.5 Procedures will also be in place to ensure that contractors undertaking work on the plant are qualified for the task they are undertaking and that they are made aware of relevant requirements of the EMS and environmental permit requirements relevant to their work. This will include all maintenance staff carrying out routine maintenance of the site in the event that any third party maintenance is required.

3.6 Records

3.6.1 The operator shall maintain records of any incident, accident, emergency or non-compliances shall be kept. All monitoring (where required by the permit) including samples and analysis results shall be recorded.

3.6.2 A copy of all documents will be held in HyBont's office and made available upon request. All records shall be kept for at least six years.

3.7 Site Security

3.7.1 The site is surrounded by 2.4 m high fencing and security gates, and CCTV cameras operating 24/7.

4 ENVIRONMENTAL RISK AND EFFECTS

4.1.1 The Hydrogen Production Facility will comply with the Generic Risk Assessment for Standard Rules set number SR2009No211, and its associate management measures.

4.1.2 Information on how the Site complies with low-impact criteria is outlined in Appendix E.

4.2 Emissions to Air

4.2.1 Emissions to air will only comprise oxygen and periodically hydrogen may be released. Neither of these gases is an air quality pollutant and consequently there are no AQ limits which require abatement.

4.3 Emissions to Water and Sewers

4.3.1 The only waste produced on site will be aqueous waste from the onsite water treatment process. This aqueous waste stream has up to 4 x concentrated mineral content and will be discharged to sewer via surface water drain under a Trade Effluent Consent without further treatment.

4.3.2 The emissions to water associated with the Hydrogen Production Facility has been assessed using the Environment Agency's H1 screening tool which concluded that the environmental effect of the discharge for all components' excluding heptachlor is considered insignificant. This is included in Appendix C.

4.3.3 Heptachlor did not screen out at Test 3 as the difference between the Predicted Environmental Concentrations and Background Concentration (assumed 50% of EQS) is greater than 10% of the Annual Average EQS. However, the incoming water supply from Welsh Water for heptachlor (0.0025 ug/l) exceeds the EQS (0.00000001 ug/l) and fails the H1 assessment at Test 3 before the onsite water treatment process. The process does not add any more heptachlor to the towns water, it merely concentrates what is already present in the water supply. This wastewater contains the same compounds that are present in the original Welsh Water towns water supply and meets the drinking water standards for heptachlor (0.03 ug/l).

4.3.4 See Drawing 3 for Drainage Plan.

4.4 Emissions to Land

4.4.1 There will be no point source emissions to land.

4.5 Odour

4.5.1 The raw materials used on site are towns water, nitrogen and fire water. Towns water, nitrogen and fire water are not odorous.

4.5.2 Accident prevention measures will be in place; in the event of a leak or a spillage accident management procedures would be followed.

4.5.3 The potential for impacts at off-site receptor, the closest of which is 35 m from the facility, is low.

[1] sr2009-no02-generic-risk-assessment-v4-nrw.xlsx (live.com)

4.6 Noise

4.6.1 A Noise Impact Assessment has been completed for the Hydrogen Production Facility and is included in Appendix B.

4.6.2 Following the initial Noise Impact Assessment, HyBont undertook an extensive mitigation and design review of the development to reduce any potential noise impacts.

4.6.3 The Noise Impact Assessment, and subsequent Technical Note, concludes that the noise associated with the proposed development, when adopting the limiting plant noise emissions levels, is expected to result in low impact. This is included in Appendix B.

4.6.4 A summary of how the Hydrogen Production Facility meets low impact criteria for noise is included in Appendix E.

REFERENCES

1. NRW Standard Rules, Low Impact Part A installation. sr2009-no02-generic-risk-assessment-v4-nrw.xlsx (live.com)

Drawing 1 Site Location Plan

Drawing 2 Site Layout Plan

Drawing 3 Drainage Layout Plan

Drawing 4 Process Flow Diagram

Appendix A
NOISE ASSESSMENT

Appendix B
H1 EMISSIONS SCREENING ASSESSMENT

Appendix C
SITE CONDITION REPORT

Appendix D
LOW IMPACT CRITERIA JUSTIFICATION

BRIDGEND PERMIT APPLICATION

Supporting Information

HyBont Limited

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Contact

20 Farringdon Street
London, EC4A 4AB
+44 20 3691 0500