Marubeni Europower

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Client: Marubeni Europower

Project: Bridgend Green Hydrogen

Project Number: 108939

Document Name: Utility & Emissions Summary

Document Number: 108939-MMD-BRGR-XX-SH-M-0028

Revision: B

Pages: 1 of 5

Rev	Date	Status	Description	By	Check	Approved
B	17-Nov-22	-	Issued for Information	A Harris	A Ho	J Paul
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1	**Introduction**	**Rev**
1.1	Document Purpose	
	Identification of the average consumption and/or peak rates for utilities and emissions to enable preliminary determination of external utility connection requirements, utility equipment sizing, dispersion behaviour, environmental permitting impact and OPEX. Also, to support preliminary selection of utility equipment types and layout development.	
1.2	Document Scope	
	The utilitiy & consumables summary is applies to the Hydrogen Prodution Facility as described in Basis of Design document 108939-MMD-BRGR-XX-RP-M-0020 Rev A.	
1.3	Document Basis	
	The Hydrogen Production Facility (HPF) is designed for 5 MW (HHV) peak hydrogen production by electrolysis, with power supplied from a local wind farm (via grid connection) and a directly connected solar PV array. A non-exhaustive list of hydrogen consumers is as follows:	
	- SARN heating network [via pipeline]	
	- Tube Trailer Loading [180 barg]	
	- Dispensing to refuse collection vehicles / road maintenance vehicles / buses [350barg]	
	- Dispensing to Light Commercial Vehicles (e.g. Blue Light Services) [700 barg]	
2	**General Notes**	
2.1	Equipment efficiency and utility consumption is indicative. EPC Contractor to update with vendor input.	
2.2	This document identifies permanent utility requirements and emissions following the completion of the project. Temporary utility requirements and emissions (e.g. during construction) are outside the scope of this document.	
2.3	Consumption of the main demineralised water treatment chemicals is calculated based on:	
	- HCl: Based on Purolite calculation template (user registration required), available from https://www.purolite.com/purolite-resin-system-modeling-software/Modeling-Software-terms-of-use	
	- NaOH: Based on Purolite calculation template, as in previous line	
2.4	Average Annual Consumption and Emissions basis:	
	> Capacity factor shall be 40% minimum.	
	> Availability considered 100% for utilities & emissions purposes (EPC Contractor to re-evaluate)	
	Therefore:	
	> For utilities and emissions which scale with power supply, annual consumption / emissions based on 40% x 8760 = 3504 full-load hours per year.	
	> For utilities and emissions independent of power supply, annual consumption / emissions based on 8760 full-load hours per year.	
	These multipliers have been used when converting kg/h (or m3/h or L/h) to average annual kg/annum (or m3/annum).	
2.5	Electrolysis efficiency basis: 4.9 kWh/Nm3 H2, with an assumed 10% efficiency loss over 7 years for electrolyer degradation (to be confirmed with vendor engagement)	

2	General Notes	Rev
2.6	TBC = To Be Confirmed VTC = Vendor To Confirm	

3	Holds
3.1	Solids / mineral content of feed water from Welsh Water to be confirmed by EPC Contractor.
3.2	EPC Contractor to determine firefighting water requirement.
3.3	EPC Contractor to finalise use of odorant for H2 pipeline leak detection, and choice of chemical.
3.4	EPC Contractor to finalise use of colorant chemical for leak detection, and choice of chemical.
3.5	EPC Contractor / Equipment Vendor to confirm hydrogen flow to cold vent due to regeneration of dehydration package or method of recyling back into process.

SYSTEM / AREA: Hydrogen Production Facility

Utility	Description of Utility Requirement	Utility Supply	Peak Operational Rate	Average Annual Consumption (Note 2.4)	Remarks	Notes / Holds	Rev
UTILITY DEMAND							
Feed Water	Mains water is used as the demineralisation plant feed, and for buildings & services.	Municipal mains water connection	2.3 m³/h	8,010 m³/annum	Peak flowrate to utilise maximum wind power generated at solar PV farm and wind generation. Includes feed water to electrolysers and other process users.	HOLD 3.1	B
Demineralised Water	Demineralised water is required for electrolysis.	Demineralised Water System	1.13 m³/h	3,977 m³/annum	Peak flowrate to utilise maximum wind power generated at the wind farm		
Closed Loop Cooling Water	Cooling water is required for temperature control of electrolyte and rectifier as well as Deoxygenation (direct cooling) and compression inter/after-cooling.	Closed loop system	VTC	VTC	Cooling water for closed loop system only. Top-up volume to be within available feed water allocation, but will be low / zero for closed loop system.		
Treatment chemicals - NaOH	NaOH is required for regeneration of the ion exchange resin in the demineralised water package, and also pH control in Oily Water Separator	Imported chemicals with bulk storage on site	1 L/h	3.50 m³/annum	Peak requirement for water treatment: 0.79 L/h.		
Treatment chemicals - HCl	HCl is required for regeneration of the ion exchange resin in the demineralised water package, and also pH control in Oily Water Separator	Imported chemicals with bulk storage on site	1 L/h	3.50 m³/annum	Peak requirement for water treatment: 0.68 L/h.		
Odorant	Odorant for hydrogen routed via pipeline to aid leak detection	Imported chemicals with bulk storage on site	TBC	TBC	Chemical TBC	HOLD 3.3	
Colorant	Colorant for hydrogen to aid leak detection	Imported chemicals with bulk storage on site	N/A	N/A	Not currently in design case	HOLD 3.4	
Electrical Power	Electrical power is required for electrolysis, compression, cooling systems and other auxillary power and utilities.	Renewable Wind (via grid) & Solar PV (via Private Wire)	7.38 MW	25.86 GWh	Start of Stack Life	Note 2.5	
			8.10 MW	28.38 GWh	End of Stack Life	Note 2.5	
Compressed Air	For distribution as service and instrument air.	Compressed air package	TBC	TBC			
Nitrogen	Provided for purging, blanketing, start-up, shut-down and emergency shutdown.	Bottle rack	TBC	TBC			
Firewater	Firewater provision as part of active protection for the plant and facilities	Towns water	1,500 L/min	22.50 m³/annum	No routine consumption of firewater. Consumption assumes a yearly test for 15 minutes.	HOLD 3.2	
Potable Water		Towns water	TBC	TBC			

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Emission / Discharge	Description of Emission Discharge	Emission / Discharge Release	Peak Operational Rate	Average Annual Emissions (Note 2.4)	Remarks	Notes / Holds	Rev
DISCHARGE / EMISSION							
Oxygen	Oxygen is produced in the electrolyser when water is split into hydrogen and oxygen.	Vent system	1.01 kg/h	3,532 kg/annum	Cold Vent: Uncombusted oxygen gas, saturated with water and with entrained water.		
Hydrogen	High pressure blowdown may be required in an emergency to safeguard personnel and assets.	Relief system	127 kg/h	N/A	Cold Vent: uncombusted hydrogen gas.		
	Dehydration unit regeneration		4 kg/h	15,575 kg/annum	Conservative assumption of 3.5% of hydrogen production - vendor to confirm.	HOLD 3.5	
Treated waste water	Effluent System will treat all process area drainage and road drainage prior to discharge offsite	Watercourse	TBC	TBC	Treatment, discharge route and wastewater recycling to be confirmed.		
Non-process area Stormwater	Stormwater from non-process areas will be discharged directly to watercourse	Watercourse	TBC	TBC	Flowrate dependent on site layout		
Sewage	Sewage from buildings & services will be discharged to municipal waste water treatment plant.	Municipal Utility Network	0.01 m^3/h	91 m^3/annum	Based on 5 persons and 50 litres per person per day		
Spent resin	Ion exchange resin is required to demineralise the towns water to protect the electrolyer.	Trucked off site to landfill or resin vendor	Nominal	Nominal	No routine discharge of solid waste. Resin replaced every 4-10 years.		
Spent deoxidiser catalyst	Deoxidiser catalyst is required to remove trace amounts of oxygen from the hydrogen product stream.	Trucked off site to landfill or catalyst vendor	Nominal	VTC	No routine discharge of solid waste. Catalysts recycled every >5 years (assumed - VTC)		
Spent dehydration adsorbent	Adsorbent is required to remove trace amounts of water from the hydrogen product stream.	Trucked off site to landfill or adsorbent vendor	Nominal	Nominal	No routine discharge of solid waste. Replacement frequency dependent on chosen technology (silica gel or molecular sieve)		
Oily Water	Carryover from Oily Water Separator	Trucked off site to treatment plant (TBC)	TBC	TBC			