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15th January 2025

Natural Resources Wales
Rivers House
St Mellons Business Park
St Mellons
Cardiff
CF3 0EY

Attention: Mr Luke Burton.

Re IPPC Permit number BL 2459.

Dear Mr Luke Burton.

Please find enclosed:

Energy Efficiency report, year ending December 2024.

Yours sincerely

[redacted]

[redacted]
Plant Manager

Air Products plc
Hersham Place, Molesey Road
Walton-on-Thames, Surrey, KT12 4RZ
Telephone (0) 1932 249992

AIR PRODUCTS (BR) LTD

PROJECT NUMBER: A3145

INSTALLATION: LLANWERN HYDROGEN INSTALLATION (BL 2459)

TITLE: Energy Efficiency Report

Distribution: **Environment Agency - Cardiff (1 copy)**
Plant Manager, UK Operations - Llanwern (APBR Ltd)
Safety & Quality, UK EH&S – HERSHAM

22	2025 Revised	15/01/2025	Plant Manager		
21	2024 revised	28/01/2024	Plant Manager		
20	2023 revised	27/01/2023	Plant Manager		
19	2022 revised	26/01/2022	Plant Manager		
18	2021 revised	27/01/2021	Plant Manager		
17	2020 revised	24/01/2020	Plant Manager		
16	2019 revised	23/01/2018	Plant Manager		
15	2018 revised	25/01/2018	Plant Manager		
14	2017 revised	30/01/2017	Plant Manager		
13	2016 revised	27/01/2016	Plant Manager		
12	2015 revised	27-01-2015	Plant Manager		
11	2014 revised	27-01-2014	Plant Manager		
10	2013 revised	14-01-2013	Plant Manager		
9	2012 revised	20-01-2012	Plant Manager		
8	2011 revised	24-01-2011	Plant Manager		
7	2010 revised	07-01-2010	Plant Manager		
6	2009 revised	08-01-2009	Plant Manager		
5	2008 revised	03/01/2008	Plant Manager		
4	2007 revised	05/01/2007	Plant Manager		
3	2006 revised	05/01/2006	Plant Manager		
2	2005 revised	10/01/05	Plant Manager		
1	2004 revised	16/4/04	Quality & Safety		
0	Original Issue	22/4/03	Quality & Safety		
REV	Description	Date	Originator		

Llanwern Hydrogen Installation Energy Efficiency Report

Objective

This report documents all the available techniques and the estimated CO2 reductions associated with these, in accordance with improvement item 9.2.

This energy efficiency report reviews the plant performance against the design, and proposes any energy efficiency improvements that might be required against the Environment Agencies PPC application template, published in December 2002. This report is kept on site and reviewed at a minimum every year, and updated if necessary.

General

The plant was commissioned in April 2002. The electrical equipment (detailed in the PPC application V3145 section 2.7) was all purchased from new for the project and to state of the art energy efficiency standards. The reformer itself and the burners were also manufactured specifically for this project and represent BAT.

BAT for energy use on the plant was described in the PPC application V3145 section 2.7). The site is covered by a CCL agreement and thus only housekeeping energy efficiency measures are subject to PPC regulation. In addition the site energy use is below the threshold for low impact installations) of 1 MW.

A Natural Gas Booster Compressor has been installed, within the Air products facility compound. This was a late request from Tata Steel, and was not included in the original energy calculations

The Booster compressor is designed to prevent loss of feed gas pressure from the Tata Steel distribution main, as more equipment is brought on line within the Tata Steel facility. (including gas fired boilers and pipeline gas supply to other sites within the Tata Steel works)

Plant Performance vs Design

Further efficiencies made, by increasing the use of purge gas for burner operation. This also reduced the natural gas required for burner operation

The plant reformer tube temperatures have been maintained.

Plant operation still to design, Customers on reduced demand since September 2008, plant load following capability increased, now 43% reduction in rates possible. The customer demands increased in 2018.

Due to the loss of one of our customers we have lowered our production again to 43% of rates, as of December 2019.

Table 1 show the basis theoretical annual energy performance

Energy source	Base units	Energy consumption Base theoretical			Emissions
	kw, kg gas	Delivered, Mwhr	Primary, Mwhr	% of total	Tonnes CO2
Electricity - National Grid	170.5	1494	4267	67%	708
Gas - burners only not feedstock	42	2120	2120	33%	403
Total		3613	6387	100%	1111
Production	kg/yr	727000			
Efficiency	MWHr/Tonne	8.79			

Table 2 shows the actual energy performance for the plant for the period January 2024 to December 2024

Energy source	Base units	Energy consumption Period Jan 2021 to Dec 2021			Emissions
	kw, kg gas	Delivered, Mwhr	Primary, Mwhr	% of total	Tonnes CO2
Electricity - National Grid	99.7	813	2322	59%	386
Gas - burners only not feedstock	34.8	1635	1635	41%	311
Total		2447	3957	100%	696
Production	kg/yr	67324			
Efficiency	MWHr/Tonne	58.78			

Comments

With load following implemented, average natural gas usage to burners has been maintained at an average of 34.8 Kg/Hr.
Minimum plant rate achievable 43% of plant production.
Customer demand for H2 below contract levels during all of 2024 as we have lost one of our customers Orb Electrical Steels, we have been exporting more to Tata Steel

Llanwern for Hydrogen firing of their steam boilers. Air Products as a company are actively seeking other markets for the excess Hydrogen at the Llanwern Facility. We are currently in the final phase of installing a hydrogen trailer fill system at Llanwern, this will be online sometime in 2024. This will restore the plants efficiency as we will be running at near 100% rates. The new plant is mostly commissioned we are waiting on a few issues, we expect to be fully operational this summer.

Energy Efficiency Plan

Continued operation of the (VAX) system. (Installed November 2007).

The VAX system collects data from the plant processor, enabling close monitoring of plant efficiency and load following.

Further routines added during 2009

The assumptions made in the original PPC application were also reviewed and remain valid. All the relevant techniques identified in the guidance note H2 have been implemented in the plant design

Relocation of Fire eye monitors, to provide better monitoring of burner flame.

This has resulted in reduced Purge gas venting, allowing more purge gas to be used for burner operation and reducing natural gas usage.

Main furnace burners replaced in summer shutdown 2013.

New plant cooling tower December 2013.

Plant gas coolers cleaned summer 2015.

Plant process heat exchangers cleaned using a CO2 surface blasting technique summer 2018.

Power meter installed to measure total power to the plant.

Plant process heat exchangers cleaned using a CO2 surface blasting technique summer 2022.

Main furnace burners replaced in summer shutdown 2022.

Main furnace insulation stripped out and replaced with new like for like material summer 2022.

The reformer tube catalyst was replaced in summer 2022.

Damaged insulation on various parts of the plant replaced during the summer shutdown of 2024.

The syngas cooler/waste heat boiler was replaced for a new like for like replacement in the summer of 2024, this included replacing the insulation.

Regarding the trending and analysis of the Smart plant efficiency, this data has been added to the KPI visualization tool via the VAX data system. This allows the plant and process support staff to monitor the Smart plant efficiency in real time

Appendix 1 Based on Environment Agencies IPPC template.

Basic energy efficient operating and maintenance measures are described in the Table below.

Table 2.7.2.1

Are documented operating maintenance and housekeeping measures in place for the following (where relevant):	Yes/no	Not relevant	Further information (reference documentation, date measures will be in place or reason why not relevant)

air conditioning, process refrigeration and cooling systems (leaks, seals, temperature control, eva porator/condenser maintenance);	Yes		Reformer catalyst changed March 2010. Syngas cooler cleaned March 2010. Syngas cooler cleaned July 2011. Syngas cooler cleaned July 2012. Syngas cooler cleaned July 2013. Reformer catalyst changed July 2013. New plant cooling tower December 2013. Syngas cooler cleaned July 2014. Plant gas coolers cleaned July 2014. Syngas cooler cleaned June 2015. Plant gas coolers cleaned June 2015. Burners check for correct operation June 2015. Syngas cooler cleaned July 2016. Reformer catalyst changed July 2016. Syngas cooler cleaned July 2017. C201 Natural Gas compressor coolers cleaned July 2017. Syngas cooler cleaned July 2018. Reformer inner/outer tubes plus catalyst changed July 2018. Process gas heat exchangers cleaned July 2018. Burners check for correct operation June 2018. Burners check for correct operation July 2019. Syngas cooler cleaned July 2019. Full cooling tower clean completed November 2019. Burners check for correct operation July 2020. Syngas cooler cleaned July 2020. Full cooling tower clean completed November 2021. Burners check for correct operation August 2021. Syngas cooler cleaned August 2021. Process gas heat exchangers cleaned using CO2 July 2022. Syngas cooler cleaned July 2022. Reformer catalyst changed July 2022. Burners replaced July 2022. Main furnace insulation replaced with like for like material. Syngas cooler cleaned July 2023. Syngas cooler replaced July 2024.

Operation of motors and drives	Yes		Maintained as part of the planned maintenance system
Compressed gas systems (leaks, procedures for use);	Yes		Small Compressed (instrument) air system part of planned maintenance
Steam distribution systems (leaks, traps, insulation);	Yes		Maintained as part of the planned maintenance system
Space heating and hot water systems;		✓	No buildings in the installation
Lubrication to avoid high friction losses;	Yes		Compressor operations and maintenance
Boiler maintenance e.g. optimising excess air;		✓	Automatic control system
Other maintenance relevant to the activities within the installation.			Reformer burners constantly monitored Fire eye monitors relocated to provide better monitoring of burner operation, and increased use of Purge gas within the burners (Also reducing natural gas usage) July 2008 Reformer furnace burners replaced July 2022.

Table 2.7.2.2

Confirm that the following physical measures are in place to avoid excessive heating or cooling losses for the following (where relevant):	Yes/no	Not relevant	Further Information (date measures will be in place or reason why not relevant)
Sufficient insulation of steam systems, heated vessels and pipework	**Yes**		September 2004. Screens installed to minimise the effects of high winds during winter conditions. Some vessel insulation replaced July 2013.
Provision of sealing and containment methods to maintain temperature	**Yes**		
Simple sensors and timers are fitted to prevent unnecessary discharge of heated liquids and gases.		✓	Discharges are only what is necessary for the blow down of the steam system
Other appropriate measures			

Table 2.7.2.3

Confirm that the following building service measures are in place for the following (where relevant):	Yes/no	Not relevant	Further Information (reference documentation, date measures will be in place or reason why not relevant)

Energy efficient lighting is in place	Yes		External flood lights with LED lighting. Internally with high efficiency fluorescent tubes (appropriate to relevant hazardous area classification) Lighting replaced with units requiring less maintenance September 2008
Energy efficient climate control systems are in place for: Space Heating Hot water Temperature control Ventilation Draught proofing		✓	No buildings in the installation

An energy efficiency plan is provided below to identify and appraise applicable energy efficiency techniques.

Table 2.7.2.4

ALL APPLICANTS			APPLICANTS WITHOUT CCA OR TRADING ONLY		
Energy efficiency measure e.g. CHP	CO_2 savings (tonnes)		Equivalent Annual Cost (EAC) £k	EAC/CO_2 saved £/tonne	Date for implementation
	Annual	lifetime			
CHP	NA	NA	N/a		
Process efficiency measures	NE	NE			

Further information

See below on CHP

As a new plant operating well within original design, no process changes planned and none evaluated (NE) at this early stage. However energy efficiency work is on going and any process changes identified will be added to the efficiency plan.

Notes

1. Refer to Energy Efficiency Guidance Note for cost appraisal methodology and CO_2 emission factors.
2. Where other appraisal methodologies have been used, state the method, and provide evidence that appropriate discount rates, asset life and expenditure (£/t) criteria have been employed

Efficient Energy supply techniques
Table 2.7.3.2

Energy supply techniques	Is this technique currently used at the installation? (Y / N)	If NO explain why technique is not appropriate or provide implementation date
Use of CHP;	No	Not economic, v low energy user There is no on or off site use for other low grade heat such as the process steam. Thus the plant is designed to operate as close as possible to steam balance, with the excess vented
Recovery of energy from waste;	No	No high calorific value streams
Use of less polluting fuels.	Yes	Natural gas is the feedstock
Others applicable to your activities		None
Further information