Air Products (BR) Limited
Queensway, Spencer Works,
Llanwern, Newport,
South Wales
NP19 4QX

Telephone Plant:	(0)1633 281614
Fax Plant	(0)1633 277191
Telephone Plant Manager	(0)1633 273405
Fax Plant Manager	(0)1932 259094

25th January 2018

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

Attention: Mr Tony Leakey

Re IPPC Permit number BL 2459

Dear Mr Leakey

Please find enclosed:

Energy Efficiency report, year ending December 2017

Yours sincerely

T C Ryan.

T C Ryan
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)
T C Ryan, UK Operations - Llanwern (APBR Ltd)
S Bradley, UK EH&S - HERSHAM

REV	Description	Date	Originator		
15	2018 revised	25/01/2018	T C Ryan		
14	2017 revised	30/01/2017	T C Ryan		
13	2016 revised	27/01/2016	T C Ryan		
12	2015 revised	27-01-2015	T C Ryan		
11	2014 revised	27-01-2014	T C Ryan		
10	2013 revised	14-01-2013	T C Ryan		
9	2012 revised	20-01-2012	T C Ryan		
8	2011 revised	24-01-2011	T C Ryan		
7	2010 revised	07-01-2010	B Campbell		
6	2009 revised	08-01-2009	B Campbell		
5	2008 revised	03/01/2008	B Campbell		
4	2007 revised	05/01/2007	B Campbell		
3	2006 revised	05/01/2006	B Campbell		
2	2005 revised	10/01/05	B Campbell		
1	2004 revised	16/4/04	S Bradley		
0	Original Issue	22/4/03	S Bradley		

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 Corus, and was not included in the original energy calculations

The Booster compressor is designed to prevent loss of feed gas pressure from the Corus distribution main, as more equipment is brought on line within the Corus facility. (including gas fired boilers and pipeline gas supply to other sites within the Corus 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 54% reduction in rates possible. The customer hopes their demands will increase in 2018.

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 2016 to December 2016

Energy source	Base units	Energy consumption Period Jan 2015 to Dec 2015			Emissions
	kw, kg gas	Delivered, Mwhr	Primary, Mwhr	% of total	Tonnes CO2
Electricity - National Grid	98.11	800	2285	63%	379
Gas - burners only not feedstock	28.76	1351	1351	37%	257
Total		2151	3636	100%	636
Production	kg/yr	411183			
Efficiency	MWHr/Tonne	8.84			

Comments

With load following implemented, average natural gas usage to burners has been maintained at an average of 28.76 Kg/Hr.
Minimum plant rate achievable 54% of plant production.
Customer demand for H2 below contract levels during 2017

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.

Power meter installed to measure total power to the plant.

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, evaporator/condenser maintenance);	Yes		Cooling system is maintained as part of the planned maintenance system Reformer catalyst changed July 2005 Processor controlled Load following installed July 2005 Full cooling tower clean completed October 2007. VAX system installed November 2007 Syngas cooler clean July 2008 Full cooling tower clean completed December 2008. 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.
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 2013.

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		