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Consulting Engineers Limited

Margam Green Energy Limited

IC5 SNCR Performance Report

ENGINEERING CONSULTING

Document approval

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Contents

1 Introduction

1.1 Background

An Environmental Permit (EP) (Ref: EPR/DP3137EG) for the operation of the Margam Green Energy Plant (the Facility) was granted to Margam Green Energy Limited by Natural Resource Wales on 20 November 2014. Construction of the facility commenced on 23 January 2015. Commissioning commenced on 22 May 2018 and was completed on 20 June 2019. Emissions of oxides of nitrogen (NO_x) are abated by an SNCR system which uses ammonia as the reagent.

The EP includes several Pre-Operational and Improvement Conditions. Improvement condition 5 (IC5) requires the following to be completed within 4 months of the completion of commissioning:

"The Operator shall submit a written report to Natural Resources Wales describing the performance and optimisation of the Selective Non Catalytic Reduction (SNCR) system and combustion settings to minimise oxides of nitrogen (NOx) emissions within the emission limit values described in this permit with the minimisation of nitrous oxide emissions. The report shall include an assessment of the level of NO_x and N_2O emissions that can be achieved under optimum operating conditions."

"The report shall also provide details of the optimisation (including dosing rates) for the control of acid gases and dioxins."

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by MGEL to produce a report to discharge IC5 for the Facility.

1.2 Methodology and data sources

This report analyses the following data, provided by Eco2, to demonstrate the optimisation of the NOx abatement system:

- Ammonia consumption;
- Fuel consumption and boiler load; and
- Emissions of oxides of nitrogen.

A record of the daily volume of ammonia used by the Facility, covering the period 1 September 2018 to 6 January 2020 has been used to determine the rate at which the Facility consumes ammonia.

Monthly fuel consumption in tonnes and monthly number of hours of boiler operation have been provided for the period 01 June 2019 to 31 October 2019. Emissions of oxides of nitrogen are available from the Continuous Emissions Monitoring System (CEMS) for 22 May 2018 to 30 September 2019. Data regarding the design specification ammonia consumption of the NOx abatement system has not been provided to Fichtner. Therefore, Fichtner is not able to provide any commentary on the actual ammonia consumption rate compared to the ammonia consumption rate which the Facility has been designed to achieve.

At this stage, monitoring data for dioxins and furans has not been undertaken and there is not any data available on emissions of dioxins and furans from the Facility. Therefore, Fichtner cannot provide any commentary on optimisation of the abatement system for these.

2 Conclusions

The data provided to Fichtner has been analysed to characterise the performance of the SNCR system during and after commissioning Since the end of commissioning the Facility operated within the half-hourly and daily emission limits for NOx specified in the EP.

Since the completion of commissioning, the Facility has slightly increased oxides of nitrogen emissions but consumed less ammonia, relative to the absolute quantity of fuel processed. Furthermore, the consumption of ammonia per tonne of fuel combusted has decreased, which demonstrates an increased efficiency in the NOx abatement system. Therefore, this demonstrates that the NOx abatement systems have been further optimised following completion of commissioning.

3 Ammonia Consumption

3.1 Daily ammonia consumption

A record of the daily ammonia consumption for the Facility has been provided. For the periods where the data is available, the daily ammonia consumption has been compared to the quantity of fuel processed. This is presented in Figure 1.

Figure 1: Ammonia consumption (kg) per tonne of wood throughput

Furthermore, a 3-day moving average has also been calculated to allow trends in the consumption and is shown in Figure 2.

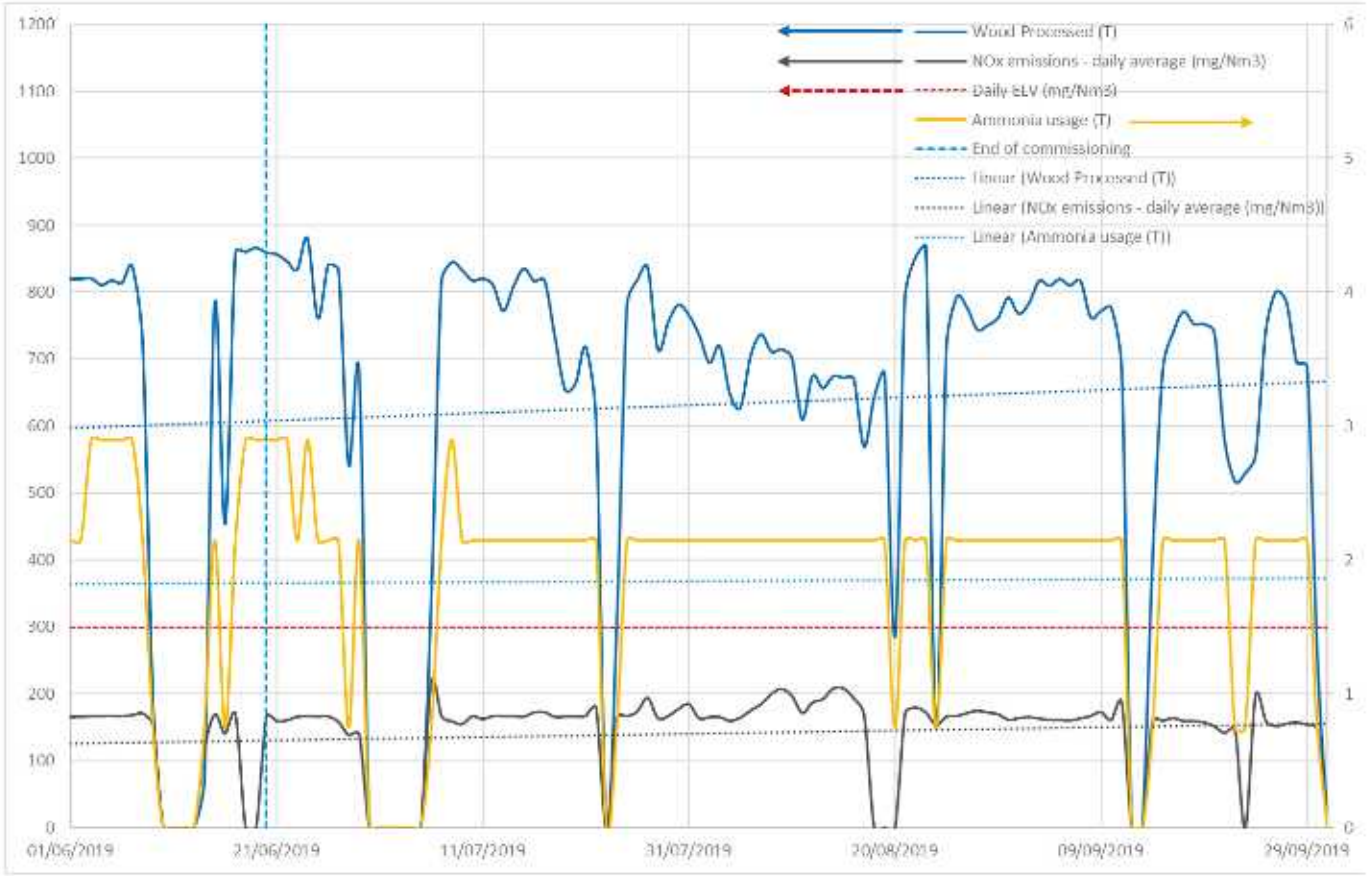
Figure 2: Ammonia consumption (kg) per tonne wood throughput, 3-day moving average

As presented in Figure 1 and Figure 2, the ratio of ammonia consumed to fuel combusted in the boiler shows an overall reduction since completion of commissioning.

3.2 Fuel consumption and efficiency of the NOx abatement system

To assess the change in efficiency of the SNCR system over time the NOx emissions and ammonia consumption has been compared to the quantity of fuel combusted. The daily average NO_x concentration has been plotted alongside the daily ammonia consumption and the daily fuel consumption, as presented in Figure 3.

Figure 3: Wood processed compared to ammonia consumption & NOx emissions (arbitrary axes)



The trend lines in Figure 3 show an increase in combustion of wood since completion of commissioning. Ammonia usage has remained constant, indicating a more efficient use of ammonia. In this same period, NOx concentrations have remained well below the emission limit value (ELV) specified in the EP.

The changes to wood and ammonia throughput and NOx emissions have been calculated from the first 7 days in June and the last 7 days in September, and the complete months of June and September. The results are presented in Table 1.

Table 1: Plant throughput, ammonia consumption and NOx emissions during operation

Period	Average Daily Wood Throughput (t)	Average Daily Ammonia Throughput (t)	Average Daily NOx Emissions (mg/Nm^3)
June 2019 – first 7 days	820.67	2.69	166.81
September 2019 – last 7 days	646.50	1.95	160.56
Percentage difference	**-21%**	**-27%**	**-4%**
June 2019 – entire month	616.37	1.88	159.87
September 2019 – entire month	653.96	1.82	161.21
Percentage difference	**+6%**	**-3%**	**+1%**

In accordance with Figure 3, the NOx emissions have remained relatively constant over the period. The reduction in NO_x emissions in the final 7 days of September 2019 is in alignment with the 21% decrease in fuel processed in that week. Comparing the entire months of July to September, wood throughput increased at a higher percentage than average NOx concentrations. During the same period less ammonia was consumed. Therefore, demonstrating that the NOx abatement system is operating at a higher level of efficiency.

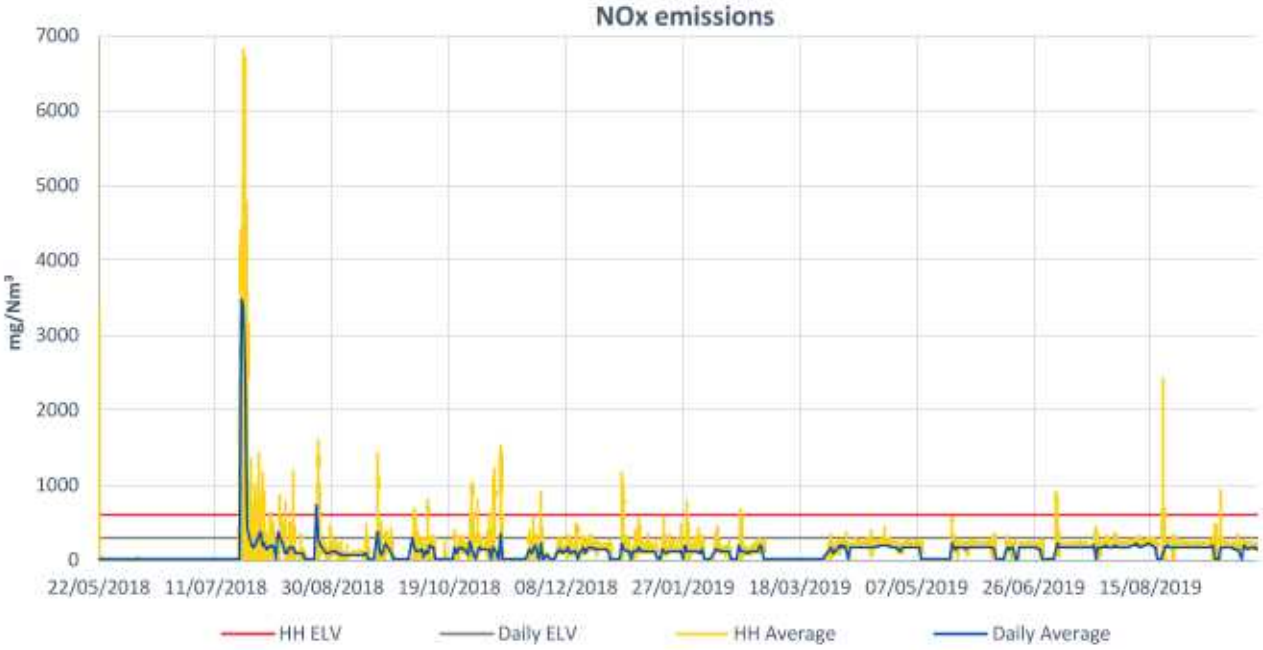
4 Emissions from the Facility

Data on the emissions of oxides of nitrogen (NO_x) from the continuous emissions monitoring system (CEMS) has been provided for the period 22 May 2018 to 20 June 2019 inclusive. The NO_x abatement system is intended to prevent emissions of NO_x from exceeding the limits specified in Schedule 3 of the EP. The emission limit values for NO_x, as set within the EP, are as follows:

- Half-hourly average: 600 mg/m^3
- Daily average: 300 mg/m^3

Emission concentrations of NOx from the Facility is presented in Figure 4.

Figure 4: Monitored NOx emissions



As can be seen in Figure 4, there has been an overall decrease in concentrations of NOx since the commencement of commissioning of the Facility.

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