

FITCH catalyst firing trials

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Equipment used for the analysis

Small 1 pack kiln (Kingsbury, Staffordshire, B77 1LT)

JCT gas cooler and sampling unit

Testo 350S multi gas analyser and data logger

Eltel Squirrel temperature data logger

FITCH catalyst and natural gas bypass

Dresser gas corrector on mains gas inlet

Pyrometrics 3mm mineral insulated thermocouples

Kestrel 4200 logging anemometer plus temperature and humidity

Aims and objectives

To assess, by trials, whether the introduction of a FITCH catalyst would result in the saving of natural gas on a brick kiln in the UK.

Testing regime

A small batch kiln, with a load of approximately 600kg, was used to assess the suitability of the catalyst on natural gas. Two trials were performed to collect data in order to establish its suitability as a gas saving device. These trials were carried out with live laboratory R&D product. Because the product had to be red (ie. fully oxidised), the burners were set up identically in a fully oxidising arrangement (air rich).

Using the information obtained from similar trials and the advice from Advanced Power Systems International, the burners were reset to dial out any carbon monoxide when the catalyst was used.

Trials

Date	Product	Load	Test	Comments
May/21	Etruria soft mud (H1) no body fuel + manganese	596 kg (calculated from average weight)	38 hour works program to 1055 °C	Catalyst off
May/24	Etruria soft mud (H1) no body fuel + manganese	594 kg (calculated from average weight)	38 hour works program to 1055 °C	Catalyst on

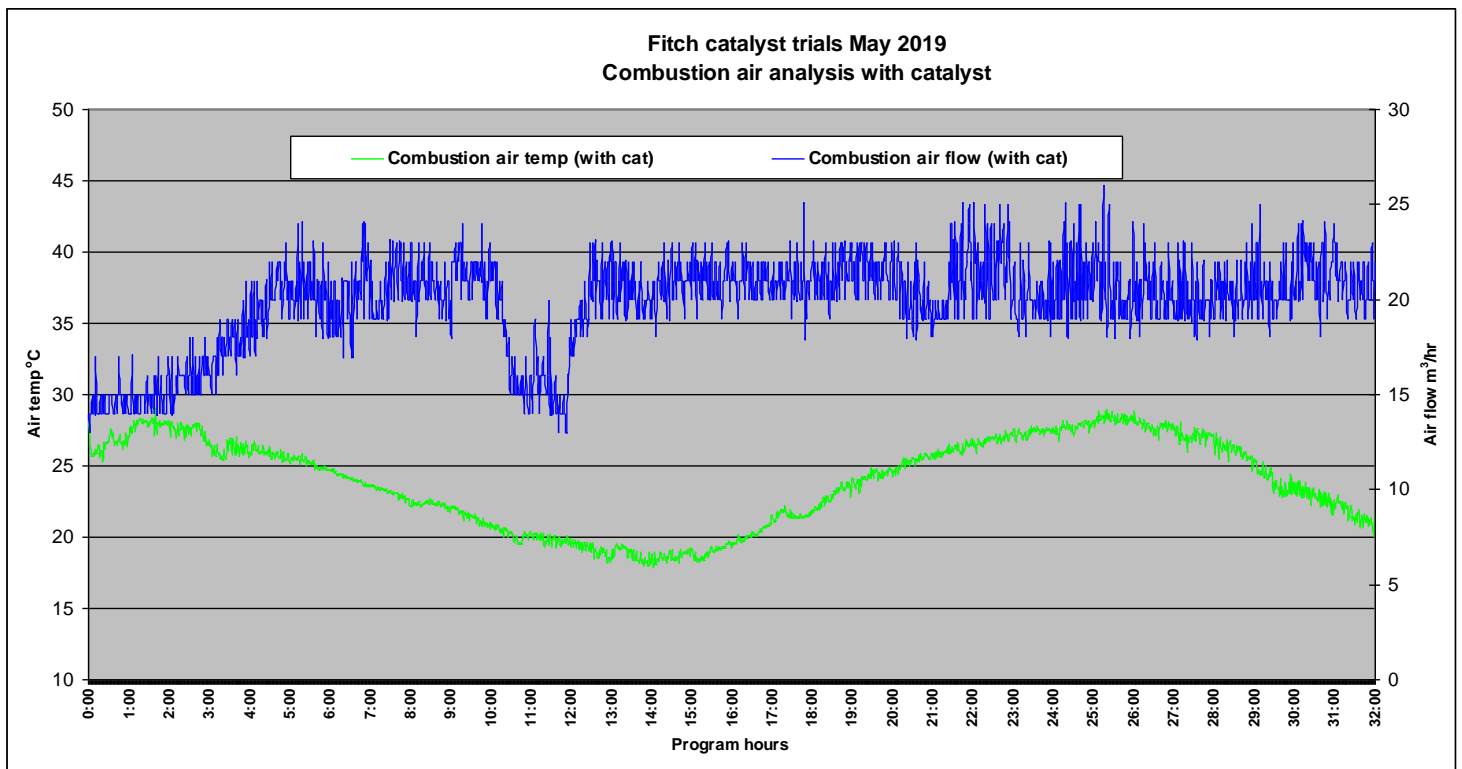
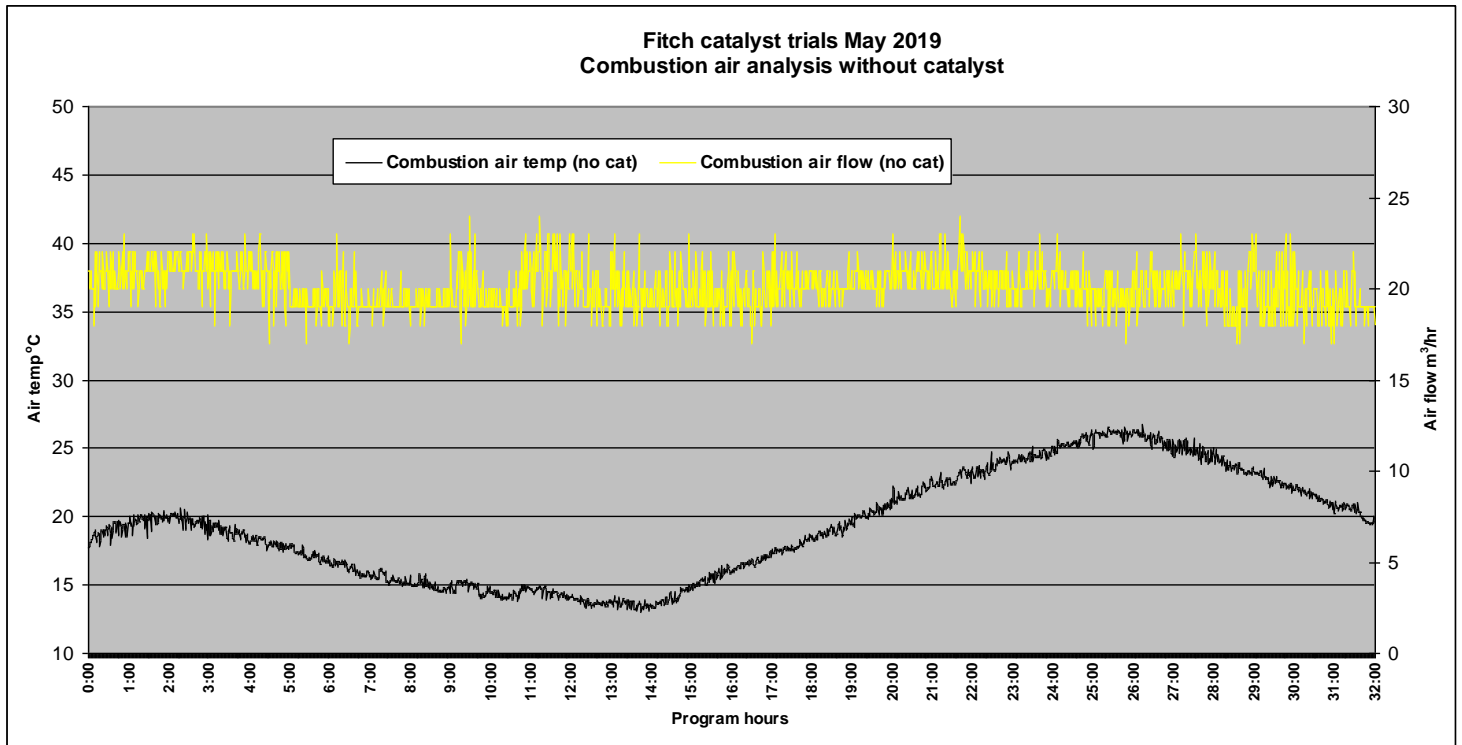
Findings

Date	Corrected gas usage	Natural gas calorific value	Specific energy consumption	Comments	Savings
May/21	13.9 m ³	39.3 MJ/m ³	254.6 kWh / tonne	Catalyst off	
May/24	13.3 m ³	39.3 MJ/m ³	244.4 kWh / tonne	Catalyst on	4.0%

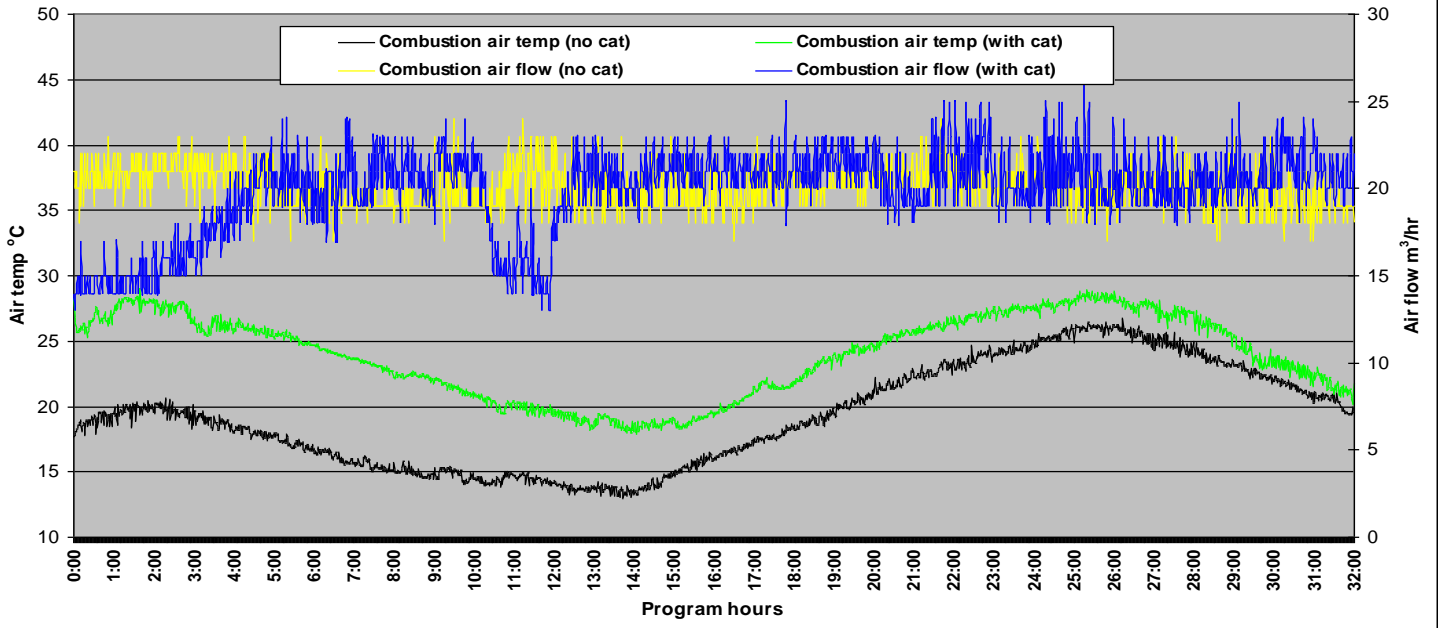
Conclusions

Despite starting with a slightly cooler kiln chamber (Appendix B) and having warmer combustion air (Appendix A) deducted from its total energy gain (1900w), the kiln firing with the catalyst engaged managed to net a 4% saving in specific energy consumption (kWh/tonne). This figure may be higher if used on a combustion system operating in near stoichiometric conditions.

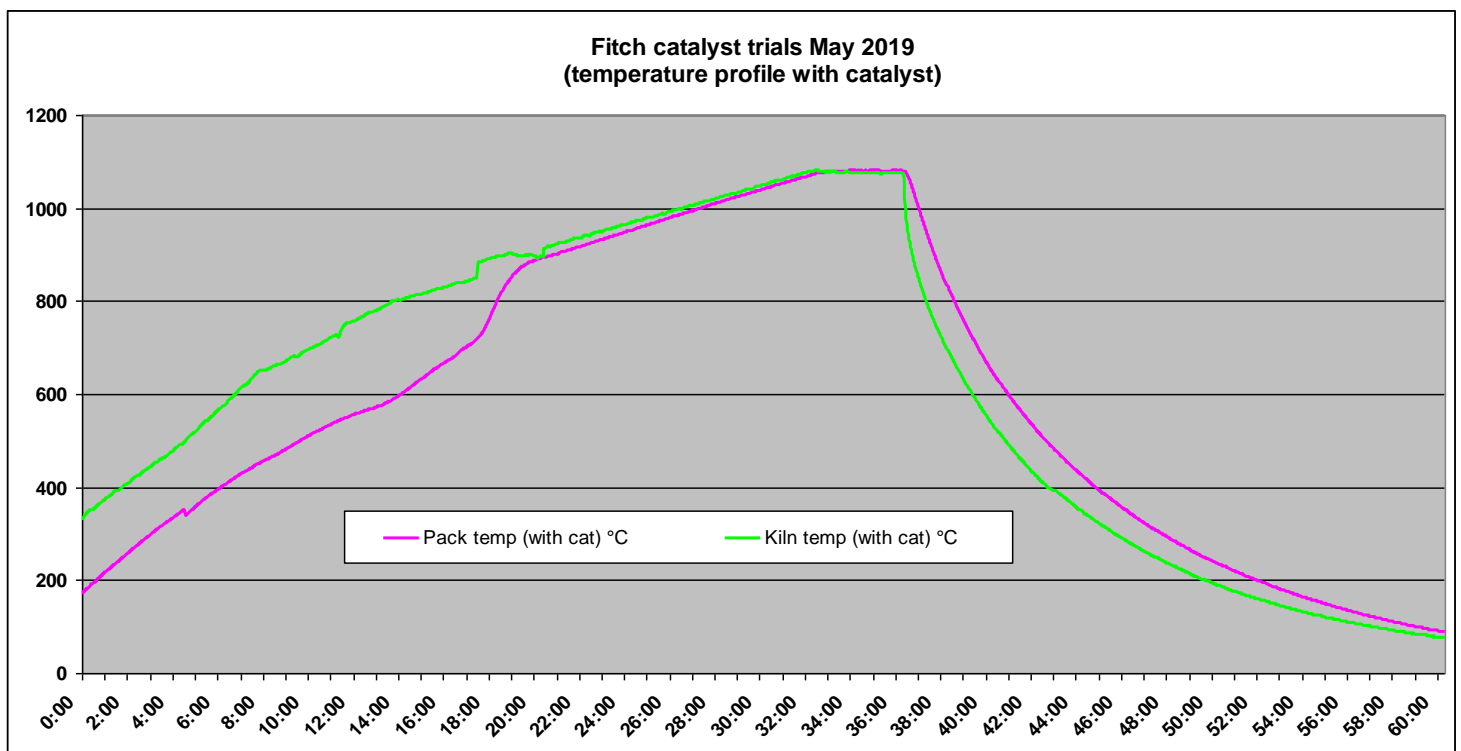
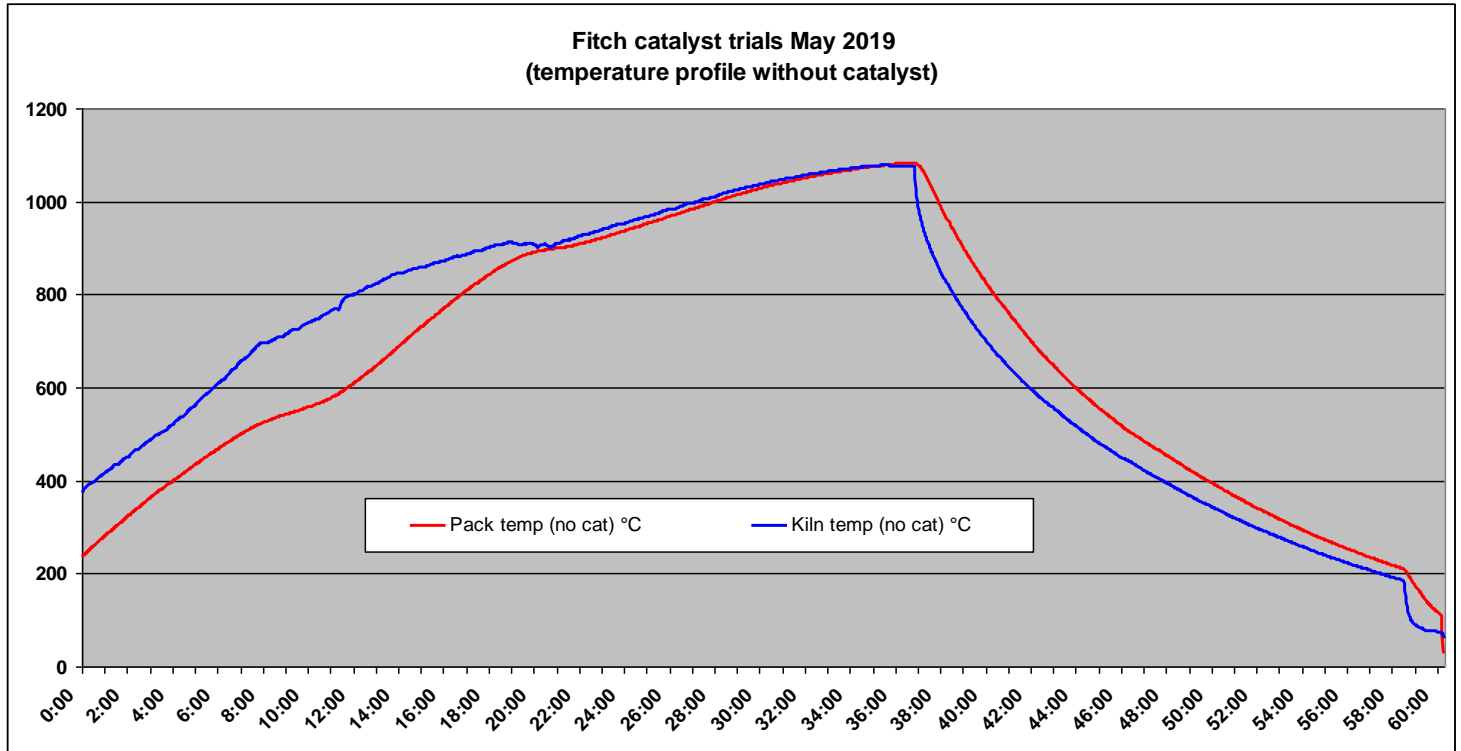
Appendix A (combustion air results)



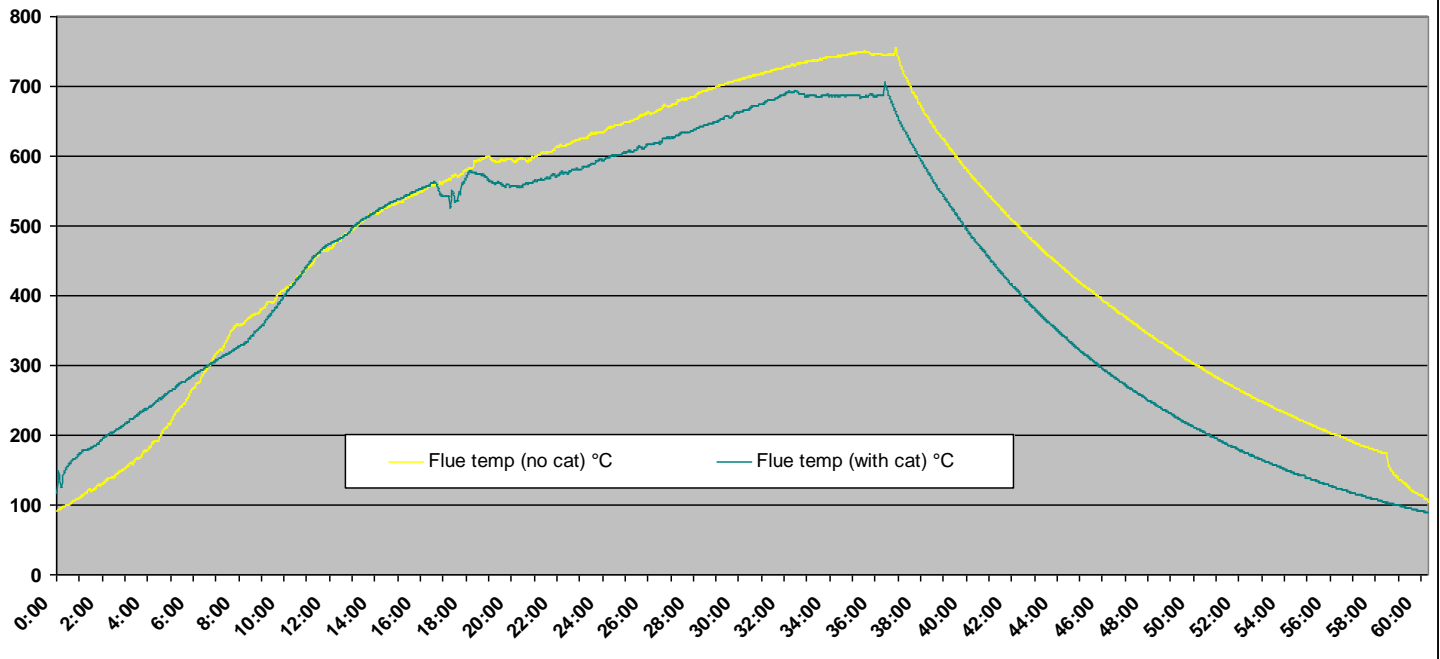
Fitch catalyst trials May 2019
Combustion air analysis (comparison with & without cat)



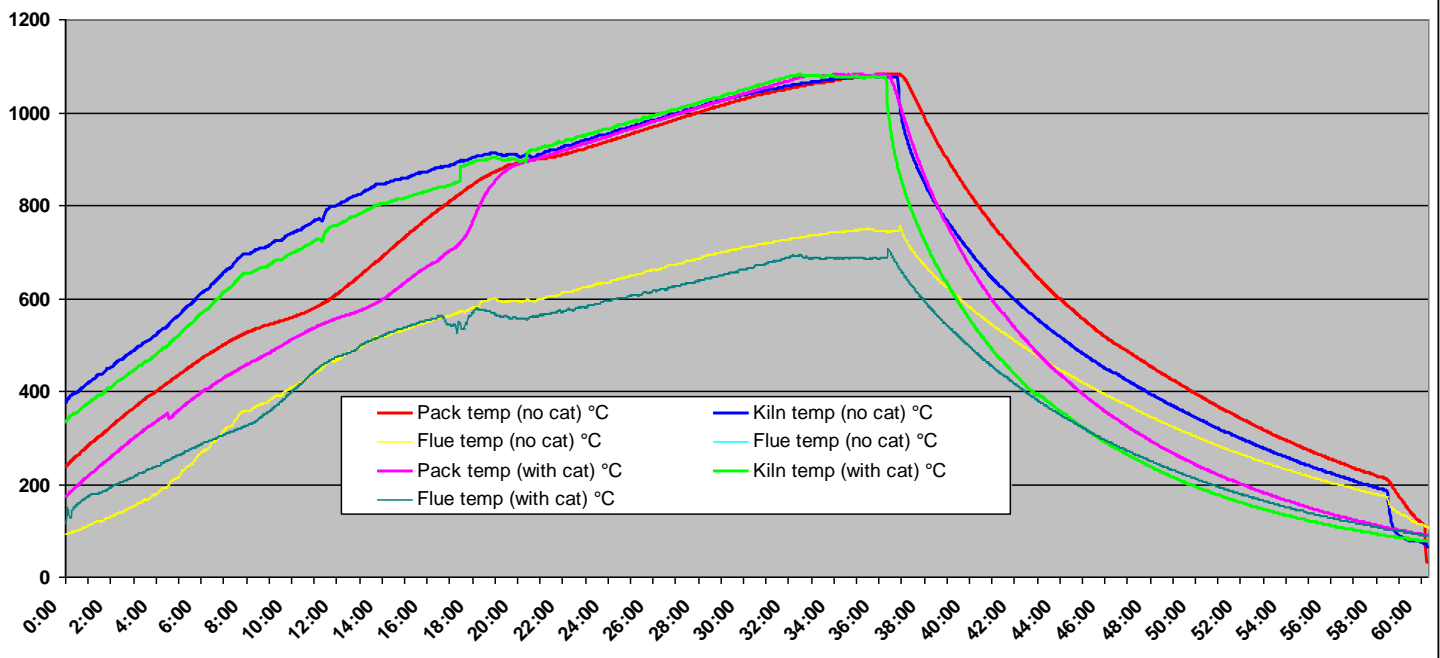
Appendix B (temperature profiles)



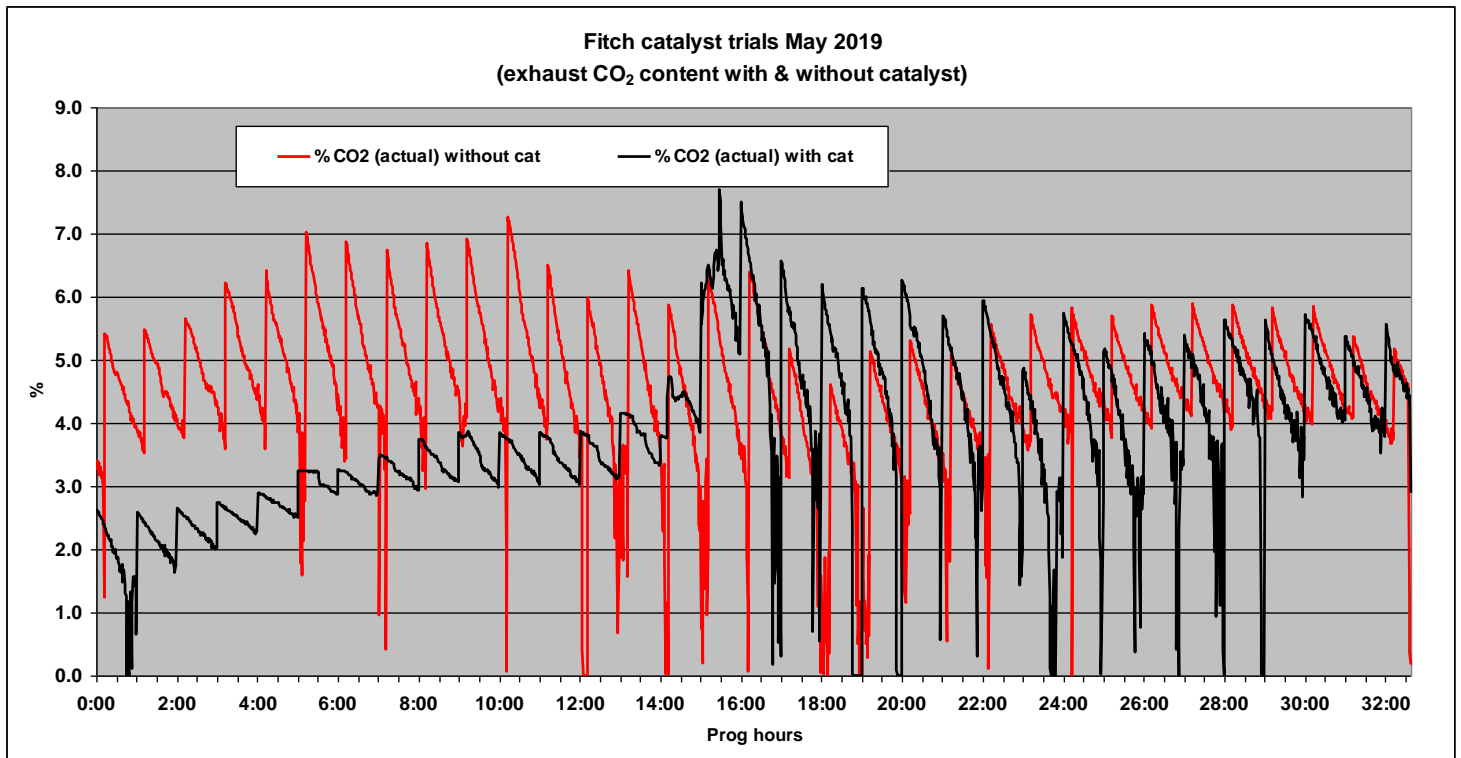
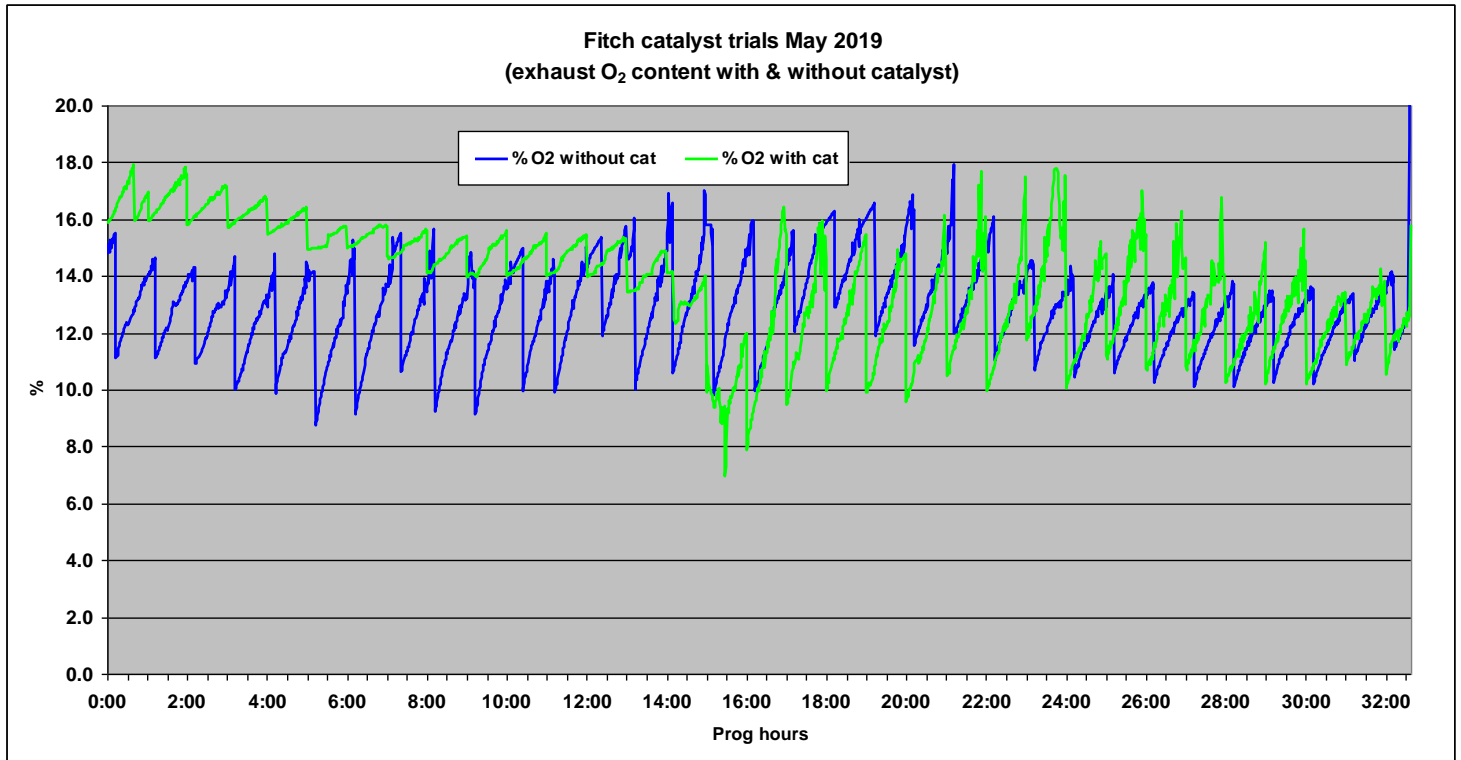
Fitch catalyst trials May 2019
(flue temperature comparison)



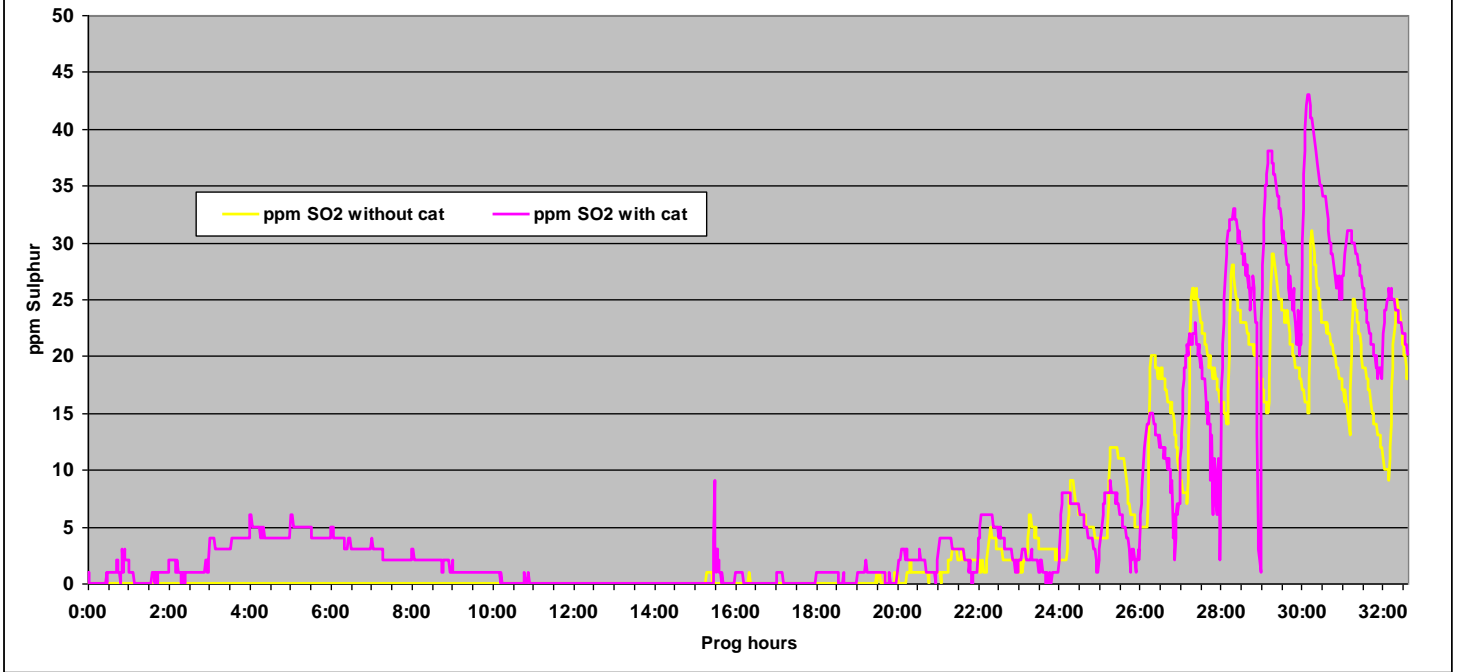
Fitch catalyst trials May 2019
(temperature comparison)



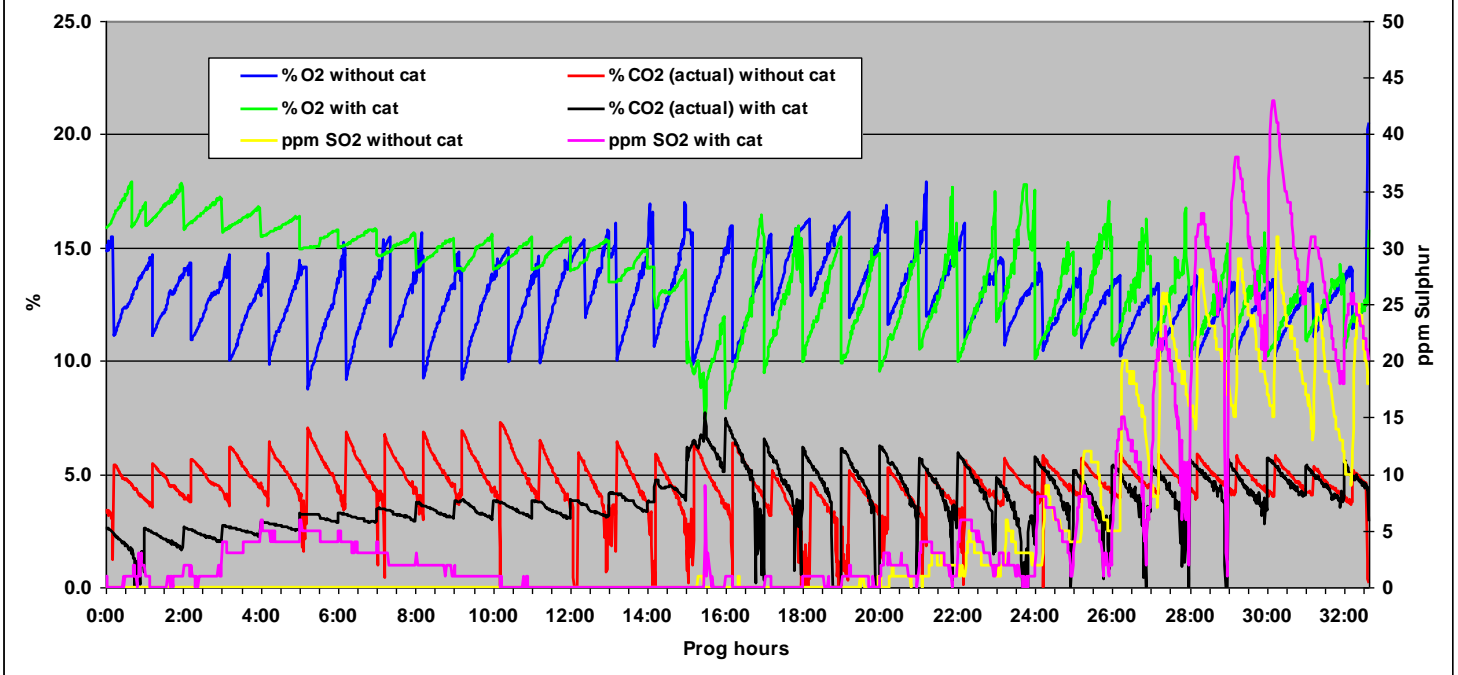
Appendix C (exhaust gas analysis)



Fitch catalyst trials May 2019
(exhaust SO₂ content with & without catalyst)



Fitch catalyst trials (exhaust gas analysis) May 2019
(with & without catalyst comparison)



Appendix D (misc data)

Gas calorific value data from Central Networks (West Midlands area)

Applicable At	Applicable For	Data Item	Value	Generated Time
26/05/2019 11:11	26/05/2019	Calorific Value, LDZ(WM)	39.3	27/05/2019 11:11
25/05/2019 10:15	25/05/2019	Calorific Value, LDZ(WM)	39.3	26/05/2019 10:15
24/05/2019 11:03	24/05/2019	Calorific Value, LDZ(WM)	39.3	25/05/2019 11:04
23/05/2019 10:20	23/05/2019	Calorific Value, LDZ(WM)	39.3	24/05/2019 10:21
22/05/2019 10:14	22/05/2019	Calorific Value, LDZ(WM)	39.3	23/05/2019 10:14
21/05/2019 10:32	21/05/2019	Calorific Value, LDZ(WM)	39.3	22/05/2019 10:32

Gas composition from Central Networks, West Midlands (May 2019)

<u>Nitrogen</u>			<u>Carbon Dioxide</u>			<u>Methane</u>		
Min	Max	Aver	Min	Max	Aver	Min	Max	Aver
1.752	3.8302	2.8844	0.7892	1.5484	0.9697	88.6613	91.7417	90.6601

<u>Ethane</u>			<u>Propane</u>			<u>i-Butane</u>		
Min	Max	Aver	Min	Max	Aver	Min	Max	Aver
3.259	5.3967	3.9787	0.6949	1.3568	0.9374	0.1295	0.2062	0.1602

<u>n-Butane</u>			<u>neo- Pentane</u>			<u>i-Pentane</u>		
Min	Max	Aver	Min	Max	Aver	Min	Max	Aver
0.1586	2299	0.1934	0.0017	0.005	0.0041	0.458	0.66	0.586

<u>n-Pentane</u>			<u>Hexane</u>		
Min	Max	Aver	Min	Max	Aver
0.385	0.554	0.491	0.5566	0.1224	0.1044

Absolute water content	0.0099	kg water / kg dry air
Diameter round duct	0.10	m
Radius round duct	0.05	m
Height rectangular duct		m
Width rectangular duct		m
Flow area	0.0079	m ²

Mass flow with catalyst in use

Average volume	19.8	m ³ /hr
Average temperature	23.9	°C
Energy	0.31	kW
Mass flow dry air	23.1	kg dry air / hour
Mass flow water	0.24	kg water / hour

Average **54.2** **23.9** **0.0099** **1.2** **19.8** **23.1** **49.3** **0.31** **0.24**

Measurement time	RH	Temp	AMC	Density	Volume	Mass dry air	Enthalpy	Energy	Mass water
dd-mm-yyyy hh:mm	[%]	[°C]	kg w/kg da	[kg wa/m ³]	m ³ /hr	kg da/h	kJ/kg da	kW	kg w/h