ANNUAL ENVIRONMENTAL REPORT

Waste Licence Registration No.:	W0167-03
Licensee:	Indaver Ireland Limited
Location of Activity:	Carranstown, Duleek, Co-Meath
Attention:	Environmental Protection Agency Office of Environmental Enforcement McCumiskey House, Richview Clonskeagh Road Dublin 14

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1. Waste Recovery Report

As a recovery option, the waste-to-energy facility can contribute to packaging recovery targets set out under the Packaging Directive (currently 60% recovery). It is estimated that up to 48,000t residual packaging waste in the MSW accepted will be recovered at the facility.

The facility contributed to the national target of diverting 50% household waste from landfill. Approximately 156,582 tonnes of municipal type waste (EWC code Chapter 20) was treated at the facility in 2016, compared with 589,693 tonnes[1] household waste disposed of to landfill in the country.

The End of Life Vehicles Directive sets a minimum reuse and recovery target of 85% from 2006 increasing to 95% reuse and recovery by 2015. Up to 10% of this target may be met through energy recovery. The Meath waste-to-energy facility is positioned to accept End of Life Vehicle residue in the form of car shred and contribute to this recovery target from 2011 onwards.
In the reporting year 2016, a figure of 1,000Kg of automotive shredder waste was accepted and recovered.

Flue Gas Residue and Boiler ash are removed from site and where possible sent to an underground salt mine in Germany. This is considered a recovery operation, R5/R11, as the mine is being back-filled with this material in order to stabilise the ground above. There are plans in 2017 to build a solidification plant at the site in order to treat the material for onward use in an Irish mine.

Ferrous metals are recovered from the bottom ash on site using a magnet and sent to metal brokers within Ireland. Indaver are also recovering non ferrous metal from the bottom ash on site using an eddy current system. This began in June 2014 and has been a successful project with good yields of non ferrous metals.

Residue	Tonnage	Recovery Option
Ferrous Metal	2923	R4
Non Ferrous Metal	695.2	R4
Flue Gas Residue	9145	R5/R11
Boiler Ash	1804	R5
Bottom Ash	15704	R11a

Bottom ash is currently being landfilled. The bottom ash is generally being used for cover or road making within the landfill which allows the recovery code R11a to be assigned.

[1] *Figures from 2012, From the National Waste Report 2012, EPA*

2. Emissions from the installation

The E-PRTR attached as appendix 1 gives an account of the emissions from the installation.

Surface Water Emissions

Surface Water/Pond
The system is monitored continuously at the DCS by the operators. The discharge is checked daily in accordance with the licence. There have been no unusual discharges in 2016. Also, no water can be discharged when the readings are over the trigger levels.

Surface Water Agreed Trigger Levels:

pH	TOC	Conductivity
6-9	Warning Level 25 mg/L Action Level 30mg/L	Warning Level 1000 μScm^{-1} Action Level 1200 μScm^{-1}

Average Results per quarter for 2016:

Quarter	pH	TOC mg/L	Conductivity μScm^{-1}	Discharge Volume m^3
Quarter 1	7.18	7.72	733	3,289
Quarter 2	7.44	12.16	364	2,434
Quarter 3	7.51	11.50	215	1,913
Quarter 4	7.10	8.70	411	1,690

3. Waste Management Record, including summary of rejected waste loads

All waste that arrives at the site is planned in advance. It is tracked through our SAP system. It is weighed prior to entry on the weighbridge and this weight is updated within the sales order on SAP. There were 3 tanker loads rejected in 2016.

Waste accepted in 2016:

Waste Type	Weight (T)
020304 WASTE UNFIT FOR CONSUMPTION	17.8
020501 FOOD UNSUITABLE FOR CONSUMPTION	80.2
070511* WWTP SLUDGE	0.06
070512 WWTP SLUDGE	4708.9
070513* PHARMA WASTE SOLID	597.852
070514 NON HAZ SOLID WASTE	21.74
070514 PHARMA WASTE SOLID	616.846
110110 SLUDGES AND FILTERCAKES	2.76
150102 EMPTY PLASTIC PACKAGING	1.792
150110* EMPTY PACKAGING WASTE	131.128
150202* FILTERS/ABSORBENTS/WIPES ORG	109.334
150203 FILTERS/ABSORBENTS/WIPES	92.74
160216 WEEE (NON HAZARDOUS)	38.46
160303* OFF SPEC LIQUID	0.001
160303* OFF SPEC SOLID	0.3
160304 OFF SPEC LIQUID	12.764
160304 OFF SPEC SOLID	3.54
160305* OFF SPEC LIQUID	136.951
160305* OFF SPEC SOLID	101.307
160306 OFF SPEC LIQUID	66.64
160306 OFF SPEC SOLID	226.098
160508* DISCARDED CHEMICALS LIQUID	3.997
161002 AQUEOUS WASTE	11.3
170204* MIXED WOOD/PLASTIC/GLASS	1
170503* SOIL AND STONES	0.5
170505* DREDGING SPOIL	0.5
170604 INSULATION	990.18
170903* C&D WASTE MIXED	0.76
180104 NON-INFECTIOUS MEDICAL WASTE	9.24
190203 PREMIXED NON HAZ WASTE	6746.76
190805 SLUDGES FROM URBAN WASTE WATER	19.96
191003* AUTOMOTIVE SHREDDER RESIDUE	1
191206* WOOD CONTAINING DANGEROUS SUBST.	0.5
191210 RDF	8041.26
191212 RESIDU FROM MECH. TREATM.	45024.62
191303* SLUDGES FROM SOIL REMEDIATION	0.498
200101 PAPER AND CARDBOARD	0.26
200127* PAINT/INK/ADHESIVES/RESINS	111.052
200128 PAINT/INK/ADHESIVE/RESIN LIQUID	0.66

200137* WOOD CONTAINING DANGEROUS SUBST.	0.64
200138 TIMBER	1.56
200139 PLASTICS	27.52
200140 METALS	26.551
200301 MUNICIPAL WASTE	154822.14
200307 BULKY WASTE	1591.392
07 05 12 NON HAZ ORGANIC SLUDGE	66.38
07 01 01* Aqueous washing liquids and mother liquors	26.24
07 05 01* Aqueous washing liquids and mother liquors	4103.734
07 05 11* Sludges from on-site effluent treatment containing hazardous substances	600.18
08 03 08 Aqueous sludges containing ink	381.56
Total	**229579**

Waste removed from facility in 2016:

Waste Description	Tonnage
13 08 99 Waste otherwise not specified	0.64
16 10 02 Aqueous liquids	88.71
17 09 04 Mixed Construction and Demolition Waste	13.322
19 01 02 Ferrous Metals	2922.76
19 01 07* Flue Gas Residue	9169.43
19 01 12 Bottom Ash	35565.732
19 01 13* Boiler Ash	1934.61
19 12 03 Non-Ferrous Metal	695.2
20 01 36 WEEE Equipment	0.29
20 01 38 Wood	6.96
20 03 01 Mixed Municipal Waste	5.2
20 03 04 Septic Tank Sludge	118.33
Total	**50521.184**

*=Hazardous waste classification

4. Resource consumption summary

Resource		Consumption in 2016
IN		
Waste	ton	229,579
Energy		
Fuel (diesel)	m3	247
Steam to use in the process	GJ	721,616
Electricity	MWh	18,037
Additives		
Quicklime	Ton	2,653
Hydrated lime	Ton	1,939
Activated carbon	Ton	108
Expanded Clay	Ton	213
ammonia	Ton	395
Water		
well water	m^3	59,256

5. Complaints Summary

All Environmental Complaints are dealt with as per the Environmental Complaints Procedure.

There were 12 environmental complaints registered in 2016. However, only 4 of these were attributable to our activities. All 2016 complaints have been closed out.

6. Schedule of Environmental Objectives and Targets

A schedule of environmental objectives and targets were set for 2016 as per section 7. A new schedule has been set up for 2017 as outlined under section 8.

7. Environmental Management Programme-report for 2016

2016 Schedule of Environmental Objectives and Targets

Item	Status	Responsible	Completion Status
Radiation Detector to be installed at the entrance to the facility	Proposal was issued to the EPA. It was rejected. Further discussions between EPA/ORP and Indaver.	Joe Crawley	NC received from EPA. New building to be installed prior to installation of detector. Ongoing discussions between EPA, ORP and Indaver
Install the pre-treatment plant for the treatment of hazardous residues	Awaiting planning permission. To be complete by end of 2016	Oliver Kelly	Planning permission and licence agreement have been received. The Outlet is awaiting their permit. Will be moved into 2017 targets.
Audit of external outlet which is used by the facility	Included in audit schedule for 2016	Grace McCormack	Complete
Complete energy audit of the facility	Proposals received and are being reviewed. Report to be reviewed and any findings followed up by including in the schedule of objectives and targets. These will include any of the actions raised during the 2015 energy audit report also.	Grace McCormack	Complete
Develop and implement an action plan for transition to ISO 14001:2015	Action plan for ISO 2015. Assess the requirements, complete gap analysis and action plan.	Mary Miller	Ongoing. Will be brought forward into 2017

8. Environmental Management Programme-proposal for 2017

2017 Schedule of Environmental Objectives and Targets

Item	Status	Responsible	Time frame
Radiation Detector to be installed at the entrance to the facility	New building to be installed prior to installation of detector. Ongoing discussions between EPA, ORP and Indaver	Joe Crawley	Planning and licence review required. End of 2018
Install the pre-treatment plant for the treatment of hazardous residues	Currently waiting for the outlet to receive their planning and permit.	Oliver Kelly	Q4 2017
Audit of external outlet which is used by the facility	Included in audit schedule for 2017	Grace McCormack	Q4 2017
Complete energy audit of the facility	In goals for maintenance department	Rory Murphy	Q4 2017
Develop and implement an action plan for transition to ISO 14001:2015	Action plan for ISO 2015. Assess the requirements, complete gap analysis and action plan.	Mary Miller	Q2 2017
New speciation study for bottom ash	After meeting with the EPA a new speciation study is to be completed	Grace McCormack	Q4 2017
Lighting	Lights to be replaced by energy efficient LED bulbs	Rory Murphy	Q4 2017
Upgrade of the surface water network	Must pass hydrostatic tests	Rory Murphy	Q4 2017

9. PRTR-report for previous year

As per the PRTR regulations, S.I. No 123 of 2007 requires that Indaver report to the Agency on an annual basis. Indaver submitted their E-PRTR on 28th March 2016 and this is attached in Appendix 1.

10. PRTR-proposal for current year

It is anticipated that Indaver will continue to monitor the air emissions as in 2016. These are TOC, HCl, HF, SO_2, NO_x, CO, dust and dioxins.

11. Noise Monitoring Report Summary

Noise level results

Monitoring Point	Date/ Start Time	Monitoring Interval (minutes)	L(A)eq	$L(A)_{10}$	$L(A)_{90}$	Audible Noise Sources
AN1-1	20/09/2016					Low level audible noise from site activities during daytime hours. Road traffic noise from R152 main audible noise source. Some site traffic noise entering and exiting main gate approx. 120m away. Low level noise from incinerator just audible during evening and night time hours.
	11:26	30	59.2	63.3	46.0	
	11:58	30	58.7	62.0	43.5	
	12:32	30	59.94	63.27	46.5	
	23:29	30	49.8	46.6	38.4	
	23:59	30	53.03	57.48	40.27	
	03/10/2016					
	20:03	30	55.99	60.84	42.86	
AN1-2	20/09/2016					Little if any noise from site activities. Road traffic noise from R152 main audible noise source. Some site traffic noise entering and exiting main gate approx. 40m away. Low level noise from incinerator just audible during evening and night time hours.
	13:14	30	69.3	71.1	50.9	
	13:45	30	69.3	70.4	49.1	
	14:27	30	68.05	72.23	51.76	
	21/09/2016					
	00:33	30	45.57	48.08	42.17	
	01:17	30	45.4	47.2	41.1	
	03/10/2016					
	20:37	30	51.37	54.06	45.09	
AN1-3	20/09/2016					Little if any noise audible from site activities. Some site traffic noise entering and exiting main gate approx. 60m away. Road traffic noise from R152 main audible noise source. Low level noise from incinerator emissions just audible during evening and night time hours.
	13:23	30	62.05	65.1	52.1	
	13:54	30	61.98	65.08	53.37	
	15:11	30	61.8	63.4	52.0	
	21/09/2016					
	00:45	30	51.9	32.3	32.3	
	01:20	30	48.74	52.08	41.21	
	03/10/2016					
	21:09	30	58.43	62.68	47.58	
AN1-4	20/09/2016					Forklift operating approx. 90m away and waste trucks unloading approx. 80m away main source of site noise during daytime hours. Noise audible from off site road traffic. Some low level audible noise from bottom ash hall during evening and night time hours.
	11:10	30	50.16	52.17	46.17	
	11:41	30	50.09	52.34	46.03	
	12:35	30	50.2	51.6	46.7	
	23:13	30	45.55	47.5	42.23	
	21/09/2016					
	00:07	30	45.0	46.3	41.3	
	03/10/2016					
	20:27	30	48.6	52.2	45.5	

Tonal or Impulsive Noise

Monitoring Point	Time of Day	Tonal or Impulsive Noise from Site Activity	Comments
AN1-1	Day, Evening & Night	No	No significant tonal and impulsive noise from site activities.
AN1-2	Day, Evening & Night	No	No significant tonal and impulsive noise from site activities.
AN1-3	Day, Evening & Night	No	No significant tonal and impulsive noise from site activities.
AN1-4	Day, Evening & Night	No	No significant tonal and impulsive noise from site activities.

Noise levels recorded at AN1-1, AN1-2 and AN1-3 are primarily due to interference noise from road traffic on the R152 which runs adjacent to the front of the facility and not as a result of Indaver site operations. The further away from the front of the facility the more reduced the noise levels are.

Noise readings at location AN1-4 did not exceed day, evening or night time noise limits except for one reading during night time hours of 45.55 L(A)eq.

LA90 readings are the noise levels recorded over 90% of the monitoring duration. These readings remove intermittent noise from the recorded noise level such as noise from passing road traffic. The LA90 readings are a truer reflection of noise from Indaver site operations. The LA90 readings were within noise limits at locations AN1-1, AN1-2 and AN1-3 for all readings.

The noise levels detected at AN1-1, AN1-2 and AN1-3 were not due to Indaver activities.

No tonal or impulsive noise from site activities was recorded during monitoring.

In conclusion, noise emissions from the site have a minimal impact on the local environment.

12. Ambient Monitoring Summary

It is a requirement of Schedule C.6.1 of W0167-03 that monthly groundwater monitoring and biannual monitoring of the groundwater monitoring boreholes takes place. Please see below a summary of the results for the same.

AGW1-1 Upgradient Monitoring Point

Monitoring Frequency	TOC(mg/L)	Ammonia (NH4) µg/L as N	Conductivity uscm-1@25C
Jan-16	1.69	10	610
Feb-16	1.47	15	596
Mar-16	1.92	12	594
Apr-16	1.51	22	588
May-16	3.289	10	593
Jun-16	1.53	10	588
Jul-16	3.1	10	605
Aug-16	1.68	10	614
Sep-16	5.97	10	610
Oct-16	20.32	12	602
Nov-16	4.5	10	603
Dec-16	1.7	10	606

AGW1-2 Downgradient Monitoring Point

Monitoring Frequency	TOC(mg/L)	Ammonia (NH4) µg/L as N	Conductivity uscm-1@25C
Jan-16	0.73	10	633
Feb-16	0.7	13	683
Mar-16	0.82	13	707
Apr-16	0.48	30	767
May-16	2.276	10	752
Jun-16	0.65	10	785
Jul-16	2.3	10	803
Aug-16	0.47	10	806
Sep-16	3.71	10	777
Oct-16	17.77	10	765
Nov-16	4.6	10	750
Dec-16	0.63	10	743

AGW1-3 Downgradient Monitoring Point

Monitoring Frequency	TOC(mg/L)	Ammonia (NH4) µg/L as N	Conductivity uscm-1@25C
Jan-16	0.5	10	617
Feb-16	0.59	10	624
Mar-16	0.65	10	631
Apr-16	0.5	10	624
May-16	2.197	10	628
Jun-16	0.69	10	619
Jul-16	3.44	10	609
Aug-16	0.43	10	616
Sep-16	4.26	10	621
Oct-16	20.97	10	631
Nov-16	5	10	624
Dec-16	0.64	10	624

Biannual Results

	AGW1-1	AGW1-2	AGW1-3	AGW1-1	AGW1-2	AGW1-3
Date	05/05/16	05/05/16	05/05/16	17/10/16	17/10/16	17/10/16
pH	7.3	7.3	7.2	7.4	7.4	7.4
Nitrate(mg/L as N)	2.2	7.05	7.69	6.64	1.62	8.52
Nitrite(mg/L as N)	<0.002	<0.002	0.002	6.64	1.62	8.29
Chloride (mg/L)	31.17	92.4	37.66	25.09	111.67	39.12
Fluoride (mg/L)	<0.02	<0.02	<0.02	0.17	0.18	0.23
Metals-Cd (ug/L)	<0.09	<0.09	<0.09	<0.09	<0.09	0
Metals Tl (ug/L)	<0.06	<0.06	<0.06	<0.06	<0.06	0.209
Metals Hg (ug/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Metals Pb (ug/L)	<0.02	0.023	<0.02	0.93	0.202	1.158
Metals Cr (ug/L)	5.483	6.183	3.839	<2.14	4.134	<2.14
Metals Cu (ug/L)	0.456	0.527	0.775	1.075	1.024	3.406
Metals Mn (ug/L)	0.262	0.349	0.151	23.48	3.164	60.41
Metals Ni (ug/L)	0.951	0.804	0.812	0.852	0.542	2.429
Metals As (ug/L)	0.302	0.301	0.25	0.615	0.268	0.847
Metals CO (ug/L)	0.237	0.316	0.168	0.277	0.076	0.733
Metals V (ug/L)	0.835	0.413	0.211	0.594	0.911	2.2
Metals Sn (ug/L)	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
Organohalogens	<5	<5	30.23	41.091	<5	<5
Total coliforms(no/100ml)	170	0	0	640	<10	<10
Faecal Coliforms(no/100ml)	0	0	0	30	<10	<10

Overall it can be stated the activities on the site at W0167-03 has no significant impact on the groundwater quality as can be shown by the above results.

13. Tank and pipeline testing and inspection report

Please see below for summary of bunds tested in 2016.
This testing is followed up on the maintenance programme in SAP.

Tank ID	Item	SAP Description	Bund Tag	Serial Number	Last Test	Next Test
1	Main diesel tank	Main Diesel Tank	UYA99-BB001	EGB10 BB001	Sep-16	Sep-19
2	3 * diesel for pump house	Fuel Tank in Diesel Pump House	UYA99-BB002	IFP-C013714-001/002/003	Jul-16	Jul-19
3	3 * diesel for pump house	Fuel Tank in Diesel Pump House	UYA99-BB003	IFP-C013714-001/002/003	Jul-16	Jul-19
4	3 * diesel for pump house	Fuel Tank in Diesel Pump House	UYA99-BB004	IFP-C013714-001/002/003	Jul-16	Jul-19
5	Back up diesel generator tank	Back up diesel generator tank	UYA99-BB005	MTD 0842	Sep-16	Sep-19
6	Transformer bunds 1 under electrical rooms (T1, T2, T3,)	T1 bund under electrical rooms	UYA99-BB006		Oct-16	Oct-19
7	Transformer bunds 1 under electrical rooms (T1, T2, T3,)	T2 bund under electrical rooms	UYA99-BB007		Oct-16	Oct-19
8	Transformer bunds 1 under electrical rooms (T1, T2, T3,)	T3 bund under electrical rooms	UYA99-BB008		Oct-16	Oct-19
12	Nitric acid spill containment	Nitric acid spill containment	UYA99-BB012	00031/TSUS/P/2010	Jan-16	Jan-19
13	Ammonia solution tank spill containment	Ammonia Tank	UYA99-BB013	EVC 056-07-09	Jan-16	Jan-19

14. Reported incidents summary

All Environmental Incidents are dealt with as per the Environmental Incident Investigation and Reporting Procedure.

There were 4 minor incidents reported in 2016. These relate to CO and low temperature.

15. Energy Efficiency audit report summary

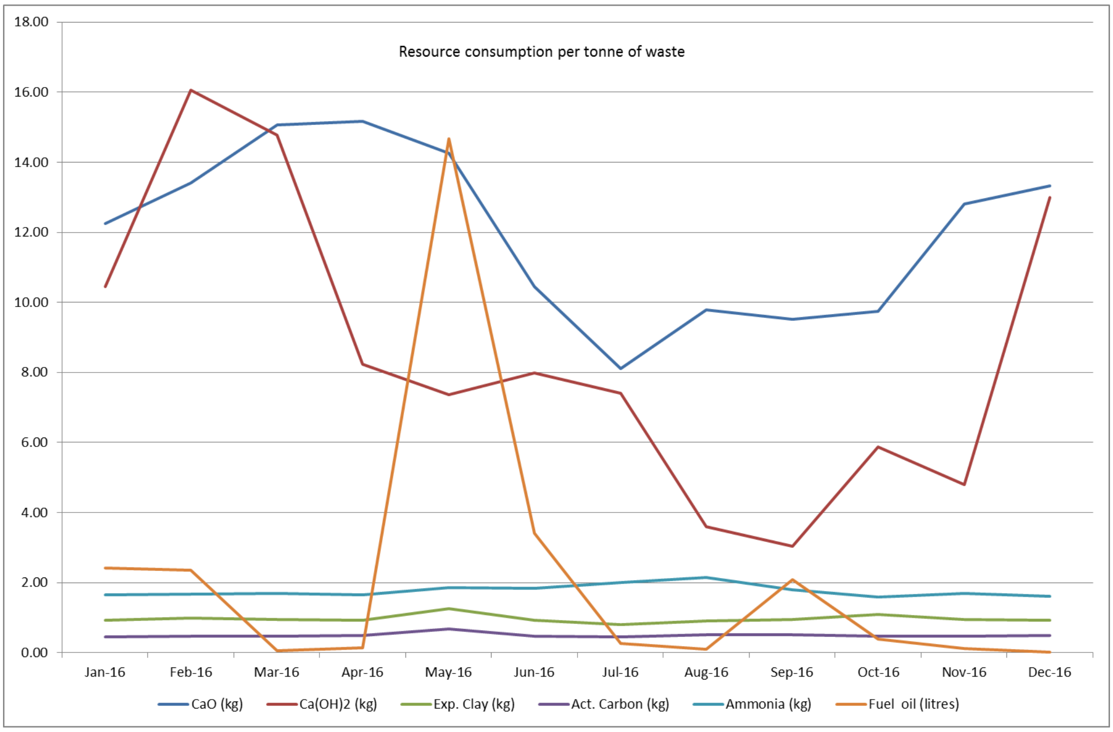
An energy audit was completed at the facility in 2016 as required by Condition 7.1.3 of W0167-03. This year the report was combined with another requirement under SI 426 of 2014.
Indaver has surpassed the requirement for 0.65 for energy efficiency and so the plant is deemed a recovery facility. The full report is attached in appendix 2.

Actions arising out of this audit report have been included in our schedule of objectives and targets.

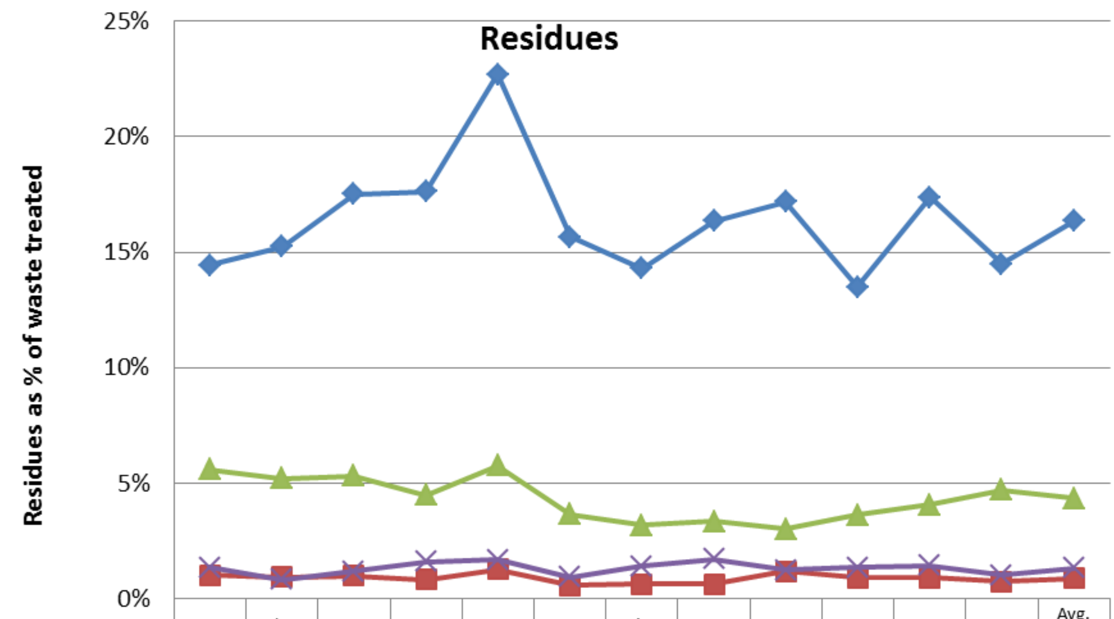
For the reporting year 2016 Indaver exported 128,513 MWh of electricity to the national grid and imported just 1,033 MWh. This is a slight decrease in the amount of electricity exported and a slight increase in the amount of energy imported. This was due to the fact that there was a 3 week maintenance outage where we need to import electricity. During this time no electricity was being exported. Indaver produce electricity to run the facility and only import electricity when in shutdown.

16. Report on the assessment of the efficiency of use of raw materials in processes and the reduction of waste generated

Indaver strive to ensure that raw consumables are used to their full effect and this is monitored continuously by the management and staff at the facility. The process engineer is tasked with reviewing this data to ensure that raw materials are used as efficiently as possible. Below is a graph showing the weight of consumable used per tonne of waste processed. The spike in diesel consumption (May 2016) was due to planned shutdown for a 3 week period in May 2016.The consumables figure for lime milk ($Ca(OH)_2$) has reduced since 2016 with improvements in process controls.



Indaver also strive to ensure that residues are monitored to ensure that the production of residues is kept to a minimum. This is again tracked by the process engineer at the site. The graph below shows the percentage of residues produced per tonne of waste treated. The spike in May 2016 in bottom ash is due to complete emptying of all bottom ash during maintenance works. Some residues are of benefit for example the ferrous metal and non ferrous metal. These residues are sent on to recovery outlets for further treatment. The majority of the other residues, bottom ash, boiler ash and flue gas residue, are used as a recovery material.



	Jan 16	Feb 16	Mar 16	Apr 16	May 16	Jun 16	Jul 16	Aug 16	Sep 16	Oct 16	Nov 16	Dec 16	Avg. YTD
Bottom ash	14.43%	15.24%	17.50%	17.61%	22.69%	15.65%	14.29%	16.34%	17.19%	13.48%	17.37%	14.48%	16.4%
Boiler ash	1.04%	0.95%	0.99%	0.84%	1.28%	0.59%	0.63%	0.63%	1.20%	0.91%	0.91%	0.74%	0.9%
Flue gas residue	5.60%	5.20%	5.33%	4.50%	5.78%	3.67%	3.20%	3.36%	3.03%	3.63%	4.08%	4.70%	4.3%
Ferrous Metals	1.37%	0.82%	1.18%	1.60%	1.70%	0.93%	1.41%	1.72%	1.26%	1.37%	1.45%	1.04%	1.3%

17. Report on progress made and proposals being developed to minimise water demand and the volume of trade effluent discharges

Indaver do not have any effluent discharges from the site. Any water that is generated in the process is re-used within the process. The water demand from the site is not large and water that is used for cleaning purposes on the site is re-used.

18. Development/Infrastructural works summary (completed in previous year or prepared for current year)

The area for the unloading of aqueous tankers on site was re-structured in 2015. This now allows two tankers to offload into the storage tank on site. These tankers can also unload directly into the aqueous injection point. The ground was demarcated to show that any spillage in this area goes towards the underground pits which are re-used in the process. Additional drainage to contain potential spillages is due for completion by end of April 2017.

In 2016 it was planned to develop an ash pre-treatment facility, subject to planning amendment permission. Indaver received an agreement from the Agency prior to infrastructural works taking place. Current projections are that works will be completed by Q4 2017.

19. Reports on financial provision made under this licence, management and staffing structure of the installation and a programme for public information

A bond is in place for the CRAMP costs at W0167-03 and was approved on 02 October 2015 and is in place until 19 June 2021. An insurance policy is in place for the ELRA costings and was approved by the Agency on the 08 March 2017.

Management structure at the site has changed and was notitifed to the Agency on 13th January 2017. The plant is run by a plant manager with a production manager (deputy plant manager), process engineer, maintenance manager and the site is supported by the quality & environmental manager, the health & safety manager and the regional project engineer. The site has production staff of 20 people on a 5-shift pattern which allows the site to run 24/7. There is also a maintenance department of 10 people and these employees comprise the Emergency Response Team.

All communications with interested parties are dealt with as per P0184 Internal & External Communications Procedure. Indaver has several visits per year from interested parties e.g. schools, universities etc. Customers and interested parties also audit the site to assess Indaver's systems and treatment of their waste streams.

Environmental information is made available to interested parties upon request.

Indaver's website, www.indaver.ie, is a valuable source of information for customers and interested parties.

20. Review of decommissioning plan

The decommissioning plan or CRAMP was updated in September 2015 to incorporate hazardous waste being accepted at the facility under the new revision licence W0167-03. This was approved by the Agency prior to the acceptance of hazardous waste at the site. This was reviewed and is still applicable.

21. Statement of measures in relation to prevention of environmental damage and remedial actions (Environmental liabilities)

The output of the risk treatment process is the development of a statement of measures to be taken to minimise the environmental risk of the activity. Since its development, the facility has been designed constructed and operated to minimise risk in every aspect of its operations.

Though additional suitable hazardous waste streams will be accepted at the facility, the same mitigation measures are in place to ensure the risk of an accident or environmental incident at the site is minimised. On the basis of the risks identified above, a statement of measures is not presently considered necessary but Indaver will continue to review operations to identify additional environmental mitigation as the need arises.

22. Environmental Liabilities Risk assessment review

The ELRA was reviewed and updated to take account of hazardous waste at the facility. This was approved by the Agency in September 2015. There is an insurance policy in place to cover the financial risks and this was agreed with the Agency in 08 March 2017.

23. Summary record of the use of the emergency generator

The emergency generator was used a total of 68 hours in 2016. It is tested weekly and these records are stored at the facility.

24. Summary of audits of waste disposal, treatment and recovery sites for the incinerator residues from the installation

During 2011, Indaver Group audited K&S, the facility for the recovery of our flue gas residues and boiler ash. The facility was approved for use and continued use.

Hammond Lane, the facility which accepts the ferrous metal from the site was audited in March 2014. The facility was approved for continued use.

United Metal, the facility which accepts the ferrous metal from the site was audited in May 2016. The facility was approved for continued use.

Rilta, the facility which accepts oil from the site was audited in December 2016. The facility was approved for continued use.

25. Report on particulates monitoring

Please refer to Appendix 1-E-PRTR.

26. Waste activities carried out at the facility

The primary operation on the Meath Waste-to-Energy Facility is the incineration of non hazardous wastes with associated energy recovery in the form of steam which is used to generate electricity. In 2015 the licence was reviewed and this now allows the acceptance and treatment of 10,000 tonnes of some suitable hazardous waste annually.

In general terms, the Meath WtE Facility is designed to incinerate and recover energy from the residual fraction of non-hazardous household, commercial and industrial waste, non-hazardous wastewater sludge and some suitable hazardous waste also. It consists of an incineration plant with energy recovery and ancillary services, and the throughput of the facility for incineration is 235,000tpa.

The facility comprises of the following main elements:

- The main process building (comprising of tipping hall, waste bunker, furnace, boiler, steam turbine, flue gas treatment and ash storage) including the control room and administration offices
- A building housing the air cooled condenser
- A contractors’ compound and office accommodation
- A warehouse building with a workshop
- A transformer compound and ESB substation with emergency generator
- A security building with weighbridge at facility entrance
- A process/firewater water storage tank and fire pump house.

The main process building is approximately 160 m long, 40 m wide at the widest point and 40 m above ground at the highest point. The stack is 65 m tall and vents the treated combustion gases to atmosphere. The plant is based on conventional grate furnace technology with a horizontal steam boiler and an advanced flue gas treatment system designed to meet the current emissions regulations. The plant will produce up to 21 MW electricity of which approximately 18MW is exported to the national grid.

Waste is transported to the site by waste contractors in accordance with the site's licensed opening hours. On entering the site, waste contractors follow a well marked two-way route to the tipping hall where inspections on the waste are conducted by Indaver on a routine basis. There is a large turning area outside the tipping hall to allow the waste delivery vehicles turn safely before entering the hall and a maximum speed limit of 15 km/h. In the tipping hall, waste is deposited into the waste bunker where it is mixed by the crane before being placed in the hopper for the furnace. Liquids are incinerated by way of the direct injection point at the aqueous unloading station or from the storage tank.

In the furnace, the waste is incinerated at temperatures exceeding 850ºC T_2S. The ash collected from the bottom of the furnace passes through a wet bath before being stored for collection and removal from the site. The combustion gases from the process pass through a number of treatment stages. This includes two stages of dosing (lime milk and lime) for acid removal and two stages of dosing (expanded clay and activated carbon) for dioxin removal, before passing through filter bags and being discharged to atmosphere via the emissions stack. The emissions to air are continuously monitored and fed back to the control room for the facility where the levels of dosing can be adjusted if required.

27. Quantity and composition of waste received, recovered and disposed of during the reporting period and each previous year (relevant ewc codes to be used)

The figures below are for incoming waste to the site. All these wastes were received and recovered at W0167-03.

Waste accepted to site in 2016

Waste Type	Weight (T)
020304 WASTE UNFIT FOR CONSUMPTION	17.8
020501 FOOD UNSUITABLE FOR CONSUMPTION	80.2
070511* WWTP SLUDGE	0.06
070512 WWTP SLUDGE	4708.9
070513* PHARMA WASTE SOLID	597.852
070514 NON HAZ SOLID WASTE	21.74
070514 PHARMA WASTE SOLID	616.846
110110 SLUDGES AND FILTERCAKES	2.76
150102 EMPTY PLASTIC PACKAGING	1.792
150110* EMPTY PACKAGING WASTE	131.128
150202* FILTERS/ABSORBENTS/WIPES ORG	109.334
150203 FILTERS/ABSORBENTS/WIPES	92.74
160216 WEEE (NON HAZARDOUS)	38.46
160303* OFF SPEC LIQUID	0.001
160303* OFF SPEC SOLID	0.3
160304 OFF SPEC LIQUID	12.764
160304 OFF SPEC SOLID	3.54
160305* OFF SPEC LIQUID	136.951
160305* OFF SPEC SOLID	101.307
160306 OFF SPEC LIQUID	66.64

160306 OFF SPEC SOLID	226.098
160508* DISCARDED CHEMICALS LIQUID	3.997
161002 AQUEOUS WASTE	11.3
170204* MIXED WOOD/PLASTIC/GLASS	1
170503* SOIL AND STONES	0.5
170505* DREDGING SPOIL	0.5
170604 INSULATION	990.18
170903* C&D WASTE MIXED	0.76
180104 NON-INFECTIOUS MEDICAL WASTE	9.24
190203 PREMIXED NON HAZ WASTE	6746.76
190805 SLUDGES FROM URBAN WASTE WATER	19.96
191003* AUTOMOTIVE SHREDDER RESIDUE	1
191206* WOOD CONTAINING DANGEROUS SUBST.	0.5
191210 RDF	8041.26
191212 RESIDU FROM MECH. TREATM.	45024.62
191303* SLUDGES FROM SOIL REMEDIATION	0.498
200101 PAPER AND CARDBOARD	0.26
200127* PAINT/INK/ADHESIVES/RESINS	111.052
200128 PAINT/INK/ADHESIVE/RESIN LIQUID	0.66
200137* WOOD CONTAINING DANGEROUS SUBST.	0.64
200138 TIMBER	1.56
200139 PLASTICS	27.52
200140 METALS	26.551
200301 MUNICIPAL WASTE	154822.14
200307 BULKY WASTE	1591.392
07 05 12 NON HAZ ORGANIC SLUDGE	66.38
07 01 01* Aqueous washing liquids and mother liquors	26.24
07 05 01* Aqueous washing liquids and mother liquors	4103.734
07 05 11* Sludges from on-site effluent treatment containing hazardous substances	600.18
08 03 08 Aqueous sludges containing ink	381.56
Total	**229579**

Waste accepted in 2015

EWC	Description of waste	Weight (Kg)
020203	020203 FOOD ANIMAL ORIG UNFIT FOR CONSUM	8460
020304	020304 WASTE UNFIT FOR CONSUMPTION	18560
020501	020501 FOOD UNSUITABLE FOR CONSUMPTION	139560
070512	070512 WWTP SLUDGE	4518020
070513	070513* PHARMA WASTE SOLID	49033
070514	070514 NON HAZ SOLID WASTE	35800
070514	070514 PHARMA WASTE SOLID	510007
080318	080318 WASTE PRINTING TONER	5800
110110	110110 SLUDGES AND FILTERCAKES	2320
150106	150106 EMPTY MIXED PACKAGING	2200
150110	150110* EMPTY PACKAGING WASTE	567
150202	150202* FILTERS/ABSORBENTS/WIPES ORG	1967
150203	150203 FILTERS/ABSORBENTS/WIPES	83000
160304	160304 OFF SPEC LIQUID	19499
160304	160304 OFF SPEC SOLID	820
160305	160305* OFF SPEC SOLID	220
160306	160306 OFF SPEC LIQUID	2720
160306	160306 OFF SPEC SOLID	236083
160508	160508* DISCARDED CHEMICALS LIQUID	47
170604	170604 INSULATION	942880
180104	180104 NON-INFECTIOUS MEDICAL WASTE	7240
190203	190203 PREMIXED NON HAZ WASTE	8274620
190805	190805 SLUDGES FROM URBAN WASTE WATER	37780
191006	191006 SHREDDINGS FROM METAL CTG WASTE	776040
191212	191212 RESIDU FROM MECH. TREATM.	45425120
200111	200111 TEXTILE	1900
200127	200127* PAINT/INK/ADHESIVES/RESINS	13840
200140	200140 METALS	2840
200301	200301 MUNICIPAL WASTE	165810150
200307	200307 BULKY WASTE	74039
02 01 07	ASH TREES	760
16 10 02	HIGH WATER WITH GLYCOL	236540
07 05 12	NON HAZORGANIC SLUDGE	103460
16 01 07*	OIL FILTERS	100
07 05 01*	PRODUCTION PROCESS LIQUID WASTE	15140
08 03 08	WASTE INK SOLUTION	308280
16 10 02	WATER FROM FIREPOND	44620

Waste accepted in 2014

Material Accepted	Quantity/Tonnes
020203 MATERIALS UNFIT FOR CONSUMPTION	14.12
020501 FOOD UNSUITABLE FOR CONSUMPTION	194.04
040222 WASTE FROM PROCESSED TEXTILE	44.68
070512 WWTP SLUDGE	5737.26
070514 NON HAZ SOLID WASTE	32.78
070514 PHARMA WASTE SOLID	230.06
080318 WASTE PRINTING TONER	136.76
110110 SLUDGES AND FILTERCAKES	4.2
150102 EMPTY PLASTIC PACKAGING	0.6
150103 TIMBER PALLETS	0.18
150203 FILTERS/ABSORBENTS/WIPES	39.46
160304 OFF SPEC LIQUID	0.22
160306 OFF SPEC SOLID	333.28
170604 INSULATION	741.38
190203 PREMIXED NON HAZ WASTE	7283.3
190805 SLUDGES FROM URBAN WASTE WATER	56.4
191006 SHREDDINGS FROM METAL CTG WASTE	498.22
191212 RESIDU FROM MECH. TREATM.	59789.52
200111 TEXTILE	19.46
200139 PLASTICS	37.78
200140 METALS	8.54
200301 MUNICIPAL WASTE	155808.42
200307 BULKY WASTE	772.18
080308 WASTE INK SOLUTION	301.41

28. Full title and a written summary of any procedures developed by the licensee in the year which relates to the facility operation

P0104	Sampling of Residues at ME1.docx	QESH	Describes the procedure for the sampling of residues at the Meath site
P0300	Radiation Procedure.docx	QESH	Covers the radiation sources at the site used for level detection
P0441	Fire Protection Systems.docx	Plant Meath	Covers the fire protection systems in place at the site
P0037	Approval and Monitoring of General Contractors.docx	QESH	Describes the procedure for the approving and monitoring general contractors that are used by the company
P0038	Approval and Monitoring of Waste Facilities.docx	QESH	Describes the procedure for the approving and monitoring of waste facilities that are used by the company
P0070	Customer Complaints and Comments.docx	QESH	Describes how to record and investigate customer complaints and comments
P0072	Customer Surveys by Means of Post Collection Questionnaires, Balance Score cards and Driver Comment Cards.docx	QESH	Part of the quality of service provision for the customer
P0093	DGSA-Non Regulated Material Incident Investigation and Reporting.docx	QESH	Describes how to investigate and report any incidents with dangerous good or non dangerous goods
P0111	Environmental Complaints.docx	QESH	Describes how to record and investigate environmental complaint
P0112	Environmental Incident Investigation and Reporting.docx	QESH	Describes how to record and investigate environmental incidents
P0113	Environmental Non Compliance.docx	QESH	Describes how to record and investigate environmental non compliance

P0171	Approval and Monitoring of Hauliers.docx	QESH	Describes the procedure for the approving and monitoring of haulage companies that are used by the company
P0184	Internal and External Communications.docx	Communications	Describes how Indaver issue communications internally and externally
P0185	Internal External and Customer Audits.docx	QESH	Describes the process of internal and external customer audits
P0201	Maintenance Of Equipment.docx	QESH	Describes how equipment is maintained
P0205	Monitoring and Measurement of Environmental Emissions.docx	QESH	Describes how environmental emissions are monitored and measured
P0278	Pre Invoicing and Invoicing MSW Customers to Meath WTE.docx	Regional Sales	Describes how customers are preinvoiced and invoiced
P0288	Processing Corrective Actions and Preventive Actions - OFIs.docx	QESH	Decribes our preventative action system
P0289	Purchase Hire and Decommissioning of Equipment.docx	QESH	Describes how to buy/hire or decommission equipment
P0292	Management of Records.docx	QESH	Describes how documents are managed within the document management system
P0359	Site Security Meath Plant.docx	Plant Meath	Describes the security on site at the Meath plant
P0360	Electricity Profiles Nomination.docx	Plant Meath	This procedure defines the actions needed to nominate electricity profiles for Meath Waste to Energy.
P0362	Waste Acceptance.docx	Plant Meath	This procedure gives clear guidelines on the type of waste that can be accepted at Meath Waste-to-Energy and the checks that are required prior to setting up the waste on Indavers systems.

P0363	Waste Handling.docx	Plant Meath	This procedure covers waste handling in the Meath Waste to Energy facility. It covers all movements of waste from the security gate to the feeding hopper.
P0348	Meath Maintenance Warehouse Management.docx	Plant Meath	The purpose of this procedure is to describe the warehouse management concept and the link with all applicable maintenance procedures.
P0383	Completing WTF and TFS Paperwork.docx	Operations	The Purpose of this procedure is to outline the steps to correctly complete WTF and TFS paperwork for shipments of waste from a customers site.
P0394	Bunker Management.docx	Plant Meath	The Purpose of this procedure isto provide an overview of Bunker Management, what is involved and who is responsible for it.
P0397	Common Shut Down.docx	Plant Meath	The purpose of this procedure is to assist the DCS/field operator when shutting down the plant from fully operational conditions to cold conditions and to outline the main responsibilities of the relevant people.
P0398	Common Start Up.docx	Plant Meath	The purpose of this procedure is to provide a guide for the process operators at the Meath waste to energy facility as to how to start the equipment on site from a complete plant shutdown.
P0399	Compressed Air.docx	Plant Meath	It describes its operational Procedures to the Operator, providing an overview of the Compressed Air Generation and Delivery system.
P0402	De-mineralised Water Plant.docx	Plant Meath	This procedure sets out how the de-mineralised water (Demin) generation plant is designed to produce the correct quality of water at a flow rate of 5m3/h to the DIW storage tanks and how this is

			achieved via plant control and DCS.
P0404	Emergency Diesel Generator Weekly Test.docx	Plant Meath	The purpose of this procedure is to explain how the Diesel Generator Weekly Test is to be completed in cooperation with the E&I maintenance team.
P0407	Fabric Filter.docx	Plant Meath	This procedure defines the actions to be taken during the operation of the Fabric Filter.
P0411	HVAC Utilities.docx	Plant Meath	The purpose of this document is to explain how the Sygma HVAC Unit works and to show how a process operator should operate it and allow the operator to monitor air handling units for the entire building.
P0413	Hydrated Lime.docx	Plant Meath	Defines the actions to be taken during the Running/Injection of $Ca(OH)_2$ Hydrated Lime to the Lab Loop.
P0418	Monthly Evacuation Alarm Test.docx	Plant Meath	To explain the procedure for carrying out the monthly fire alarm test done by shift leader/deputy shift leader.
P0420	Nitric Acid.docx	Plant Meath	To define the actions to be taken during the replacing of the nitric acid IBC.
P0423	Process Water and Mains Water.docx	Plant Meath	This procedure provides an overview of the Process Water and Mains Water System and describes its Operational Procedures to the Operator.
P0426	Restart Following Power Failure.docx	Plant Meath	The purpose of this procedure is to explain how to restore mains power to the plant following a complete power failure.

P0431	Steam and Condensate DCS Hot Start Up.docx	Plant Meath	This procedure instructs operations personnel on the actions that must be carried out by the DCS operator when starting the steam and condensate system while the process is heating up after a complete plant shutdown.
P0432	Steam and Condensate Field Hot Start Up.docx	Plant Meath	This procedure sets out to instruct operators in the Meath waste to energy facility what actions are required to start the steam and condensate cycle from a hot condition when the system is heating up to operational temperature after a shutdown for maintenance work.
P0433	Steam and Condensate System DCS Cold Start Up.docx	Plant Meath	This procedure instructs operators in the Meath waste to energy facility what actions are required to start the steam and condensate cycle from a cold condition where all system components have been completely cooled, isolated and drained for maintenance work during a plant shutdown.
P0434	Steam and Condensate System Operating.docx	Plant Meath	This procedure is to instruct operations personnel working in the plant on the actions that must be carried out on items of equipment by the operator when the steam and condensate cycle is in normal operation.
P0435	Steam and Condensate System Shutdown.docx	Plant Meath	The purpose of this procedure is to instruct operations personnel working in the plant on the actions that must be carried out on items of equipment by the operators when the steam and condensate cycle is being shutdown.
P0436	Steam Sootblowers.docx	Plant Meath	The purpose of this procedure is to outline the steps to be taken in the operation of the steam sootblowers.

P0437	Surface Water Attenuation Pond and Fire Water Retention Tank.docx	Plant Meath	This procedure provides an overview of the Surface & Fire Water System, and describes its Operational Procedures to the Operator.
P0439	Turbine Operation.docx	Plant Meath	This procedure is to instruct Indaver operations personnel in the basic functions of each of the turbine components, the safety measures that must be taken when working with the turbine and the actions that must be carried out by the DCS and field operators in order to start, operate and shutdown the turbine.
P0442	Checklists.docx	Plant Meath	This procedure details what checklists need to be filled out, by whom and how often for the Meath Waste to Energy facility.
P0443	Pump Change Over.docx	Plant Meath	The purpose of this procedure is to detail what pumps need to be switched between duty and stand by, who can switch them out and when they can be switched out.
P0455	Working at Height.docx	QESH	This procedure describes the measures used to prevent accidents from working at height or above a depth and applies to all sites.
P0057	Classification and Identification of Waste.docx	Operations	This procedure defines the steps to be taken when a waste item or list of waste items, requiring identification & classification, is received by the technical department or from a customer or any other route and how the identification & classification is recorded. It includes both waste produced by Indaver clients and waste produced at any Indaver facilities.

P0353	Control of Hot Work Procedure.docx	QESH	This procedure is to specify the manner in which hot work is managed and controlled at the Indaver Ireland & UK facilities to prevent/minimise the potential for fire or other risks to health and safety associated with hot works and ensure the safety, health & welfare of persons involved in hot works and any other persons that may be affected by the activity.
P0355	Excavations and Underground Works.docx	QESH	The purpose of this procedure is to provide a standard operating procedure and permit system for excavation and underground works at Indaver Ireland's facilities to ensure such works are properly controlled to prevent personnel injury and/or damage to Indaver's facility or the environment.
P0356	Facility Safety Induction Meath .docx	QESH	The purpose of this procedure is to clarify the Site Safety Induction process for Contractors, Hauliers and Visitors to the Meath Plant.
P0367	Financial Procedure for Electricity Charges – Supply and Generation.docx	Finance & Administration IE/UK	This procedure describes the process for ensuring all payments relating to electricity generation & supply, and ensure that they are made on time and in line with requirements.
P0352	General Permit to Work Procedure.docx	QESH	This procedure describes the General Permit to Work system in operation at Indaver Ireland & UK and sets out scope and requirements of the permit to work system so that employees, contractors, plant and environment are protected and work is carried out in a safe, environmentally sound and controlled manner.

P0173	HazID Safety Study.docx	QESH	The purpose of this procedure is to: • Describe the system by which hazards that could lead to Major Accidents • Ensure that the process for Hazard Identification and Risk Assessment (HAZID) is sufficiently comprehensive to identify all potential Major Accident Hazards associated with Indaver's activities • Ensure that the Indaver management is aware of the hazards with potential for Major Accidents on-site. • Fulfil the requirements for demonstrating that Major Accident Hazards have been identified, that the risk of occurrence and severity are assessed and that installations and systems of work at Indaver are, so far as is reasonably practical, without risk for man and the environment • Identify essential inputs for emergency planning purposes.
P0174	Health and Safety Checks.docx	QESH	The purpose of this procedure is to ensure that the relevant Health & Safety Checks are carried out at the following locations: Dublin Port Hazardous Waste Facility, Civic Amenity Sites ,Office Environment,At any of the workstations where Indaver Employees work, Any other work location to which the procedure applies.
P0175	Health and Safety Incident Investigation and Reporting.docx	QESH	This procedure outlines the reporting and investigation procedure to be followed in the event of a health and safety incident.

P0178	Identification of Safety Critical Components of an Installation.docx	QESH	This procedure deals with the identification of the safety-critical components of a technical installation and covers the following aspects: definition of safety-critical components, description of ‘DE FACTO’ and ‘POTENTIALLY’ safety-critical components, method for identifying safety-critical components and inspection programmes for the various types of safety-critical components.
P0301	Indaver Personnel Visiting the Meath Facility.docx	QESH	This procedures outlines the requirements upon arrival at the Meath facility for all Non Meath based Indaver personnel.
P0445	IT Business Continuity.docx	Business Support	The purpose of this procedure is to explain how IT systems and operations can be maintained if Irish operations loose network access with the network servers in Belgium.
P0354	Lock Out Tag Out Procedure.docx	QESH	The purpose of this procedure is to ensure that when invasive work is carried out on equipment containing hazardous energy, that such energy is properly isolated and controlled prior to commencing work so that persons are not exposed to hazardous energy.
P0204	ME1 - Calculating Recovery Code R1 Status.docx	Plant Meath	The purpose of this procedure is outline the method for validating the recovery (R1) status for ME1, which is required by the EPA in the plant's Waste Licence.
P0293	Raising a TFS.docx	Sales & Marketing IWS	The purpose of this procedure is to detail how to complete and obtain authorisation for a Transfrontier Shipment document (TFS) in Ireland and the UK.

P0318	Shipment of Controlled Drugs and Scheduled Substances.docx	Operations	The purpose of this procedure is to outline the steps needed to identify controlled drugs and scheduled substances, detail the documentation required for their shipment and to outline the steps involved in obtaining this documentation.
P0327	The HAZOP Safety Study.docx	QESH	This procedure outlines how HAZOP Safety Studies are conducted.
P0477	Maintain Technical File.docx	Plant Meath	The purpose of this procedure is to describe the system to maintain the technical files for the Meath WTE Facility.
P0478	Scaffolding Management.docx	Plant Meath	This procedure is to ensure the safe use of scaffolds, including checks and use by workers, supervisors, and scaffold qualified persons.
P0487	Injection Of Polluted Water into the Furnace.docx	Plant Meath	This sets out an overview of the Polluted Water Injection process, operations and who is responsible for it.
P0489	Electricity Permits and Licence Compliance Procedure.docx	Plant Meath	This procedure outlines Indaver Meath Plant's obligations and procedures for meeting obligations set out in licences, agreements and codes applicable to electricity exports and imports for the Meath waste-to-energy facility.
P0525	Electricity Permits and Licence Compliance Procedure-QESH.docx	QESH	This procedure outlines obligations and procedures for meeting obligations as set out in licences, agreements and codes applicable to electricity exports and imports for the Meath waste-to-energy facility as they relate to QESH activities.
P0536	Isolation of the Hydraulic Accumulators.docx	Plant Meath	This procedure defines how to carry out the de-energising and isolation of the hydraulic accumulators for the chute dampers.

P0357	Analysis of liquid samples for ME 1 Indaver Waste to Energy Facility.docx	QESH	This procedure describes all analysis necessary for tankers going to Indaver's waste to energy facility ME 1.
P0540	Boiler pressure test (40 bar).docx	Plant Meath	This procedure is describes the steps required to perform a 40 bar pressure test of the boiler, after boiler repairs.
P0560	SEAI Monthly Electricity Generator Survey.docx	Plant Meath	This document sets out how Indaver submit monthly statistical data relating to the Energy Policy Statistical Support Unit of the Sustainable Energy Authority of Ireland.
P0558	Turbine over-speed test.docx	Plant Meath	The purpose of this procedure is detail how the annual over-speed test on the turbine is to be carried out.
P0562	Acceptance of controlled and scheduled substances at ME1.docx	Plant Meath	The purpose of this procedure is to; • outline the steps needed to identify controlled and scheduled substances; • detail the documentation required for their shipment; • outline the steps involved in obtaining this documentation; • outline the transport arrangements for moving the waste to the outlet for destruction; and • outline the supervision required and security measures to be taken at the outlet should it be an Indaver facility.
P0566	Completing a Test Programme.docx	QESH	The procedures details the steps and timelines for completing a test programme under W0167 and any of its associated revisions.
P0568	REFIT (electricity) procedure.docx	Regional Sales	This procedure outlines obligations and procedures for receiving the Renewable Energy Feed in Tariff for the Meath waste-to-energy facility.

29. Review of nuisance controls

Indaver ensures that the following do not cause nuisance at the site. Vermin, birds, flies, mud, dust, litter and odour. Vermin is controlled by an external contractor who comes to site monthly and reviews the status of the site. There is no issue with vermin at the site. Birds are monitored to ensure they are not causing nuisance. Flies are not an issue at the site. Mud, dust, litter and odour are taken care of through good operational practices at the site. Negative pressure in the tipping hall and bunker area ensures that no odours escape. It also ensures that dust and windswept litter are minimised. A road sweeper comes to site on a monthly basis as a minimum which ensures no mud and dust is present to cause a nuisance. Litter picks are completed as and when necessary. Routine odour assessments are also undertaken at the site.

Appendix 1: E-PRTR plus acceptance verification

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2016

1. FACILITY IDENTIFICATION

Parent Company Name	Indaver Ireland Limited
Facility Name	Indaver Ireland Limited (Duleek)
PRTR Identification Number	W0167
Licence Number	W0167-03

Classes of Activity

No.	**class_name**
-	Refer to PRTR class activities below

Address 1	Carranstown
Address 2	Duleek
Address 3	Meath
Address 4	
	Meath
Country	Ireland
Coordinates of Location	-6.39215 53.6765
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Grace McCormack
AER Returns Contact Email Address	grace.mccormack@indaver.ie
AER Returns Contact Position	Quality and Environmental Manager
AER Returns Contact Telephone Number	041 213 4005
AER Returns Contact Mobile Phone Number	086 046 4224
AER Returns Contact Fax Number	N/a
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	39
User Feedback/Comments	There has been some changes of over 50% in the emissions to air, some are higher and some are reduced, it is based on the acid load that is present in the waste that the SO2 is higher, lower for others but essentially the waste controls a lot of the results for the emissions. For PM10, the result is an average result for 2016 multiplied by the flow rate and run hours. The measurement uncertainty on the result is very close to the average result for 2016.
Web Address	www.indaver.ie

2. PRTR CLASS ACTIVITIES

Activity Number	**Activity Name**
5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste
5(c)	Installations for the disposal of non-hazardous waste
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	

This question is only applicable if you are an IPPC or Quarry site

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
02	Carbon monoxide (CO)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	9211.85	9211.85	0.0	0.0
03	Carbon dioxide (CO2)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	324845880.0	324845880.0	0.0	0.0
80	Chlorine and inorganic compounds (as HCl)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	2010.77	2010.77	0.0	0.0
84	Fluorine and inorganic compounds (as HF)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	228.7	228.7	0.0	0.0
21	Mercury and compounds (as Hg)	M	EN 13211:2001		6.91	6.91	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	218880.62	218880.62	0.0	0.0
86	Particulate matter (PM10)	M	OTH	US EPA M01A	625.08	625.08	0.0	0.0
47	PCDD + PCDF (dioxins + furans)(as Teq)	M	EN 1948-1 to3:2003		0.0000049	0.0000049	0.0	0.0
11	Sulphur oxides (SOx/SO2)	M	OTH	EN 14181 (Continuous monitoring using FTIR)	53297.86	53297.86	0.0	0.0
05	Nitrous oxide (N2O)	M	OTH	TGN M22	2058.1	2058.1	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
210	Dust	M	OTH	EN 14181	107.38	107.38	0.0	0.0
351	Total Organic Carbon (as C)	M	OTH	EN 14181 (Continuous monitoring using FID)	707.78	707.78	0.0	0.0
347	**Total heavy metals**	M	EN 14385:2004		0.000962	0.000962	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Indaver Ireland Limited (Duleek)

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used: Method Code	Method Used: Designation or Description	Facility Total Capacity m3 per hour	
Total estimated methane generation (as per site model)	0.0				N/A	
Methane flared	0.0				0.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	0.0				N/A	

4.2 RELEASES TO WATERS

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

	RELEASES TO WATERS
POLLUTANT	
No. Annex II	Name

* Select a row by double-clicking on the Pollutant Name (Column B)

SECTION B : REMAINING PRTR POLLUTANTS

	RELEASES TO WATERS
POLLUTANT	
No. Annex II	Name

* Select a row by double-clicking on the Pollutant Name (Column B)

SECTION C : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

	RELEASES TO WATERS
POLLUTANT	
Pollutant No.	Name

* Select a row by double-clicking on the Pollutant Name (Column B)

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should N

			Please enter all quantities in this section in KGs	
	Method Used			
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year
			0.0	0.0

) then click the delete button

			Please enter all quantities in this section in KGs	
	Method Used			
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year
			0.0	0.0

) then click the delete button

			Please enter all quantities in this section in KGs	
	Method Used			
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year
			0.0	0.0

) then click the delete button

OT be submitted under AER / PRTR Reporting as this only concerns Releases from your facility

QUANTITY	
A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0

QUANTITY	
A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0

QUANTITY	
A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

4.4 RELEASES TO LAND

Link to previous years emissions data

SECTION A : PRTR POLLUTANTS

	RELEASES TO LAND
POLLUTANT	
No. Annex II	Name

* Select a row by double-clicking on the Pollutant Name (Column B)

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

	RELEASES TO LAND
POLLUTANT	
Pollutant No.	Name

* Select a row by double-clicking on the Pollutant Name (Column B)

			Please enter all quantities i
METHOD			
	Method Used		
M/C/E	Method Code	Designation or Description	Emission Point 1
			0.0

) then click the delete button

			Please enter all quantities i
METHOD			
	Method Used		
M/C/E	Method Code	Designation or Description	Emission Point 1
			0.0

) then click the delete button

in this section in KGs	
	QUANTITY
T (Total) KG/Year	A (Accidental) KG/Year
0.0	0.0

in this section in KGs	
	QUANTITY
T (Total) KG/Year	A (Accidental) KG/Year
0.0	0.0

Please enter all quantities on this sheet in Tonnes

0

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used M/C/E	Method Used	Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
To Other Countries	06 01 05	Yes	0.0	nitric acid and nitrous acid	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
To Other Countries	06 01 06	Yes	0.0	other acids	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
To Other Countries	06 02 03	Yes	0.0	ammonium hydroxide	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
To Other Countries	06 02 04	Yes	0.0	sodium and potassium hydroxide	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
To Other Countries	13 02 08	Yes	0.0	other engine, gear and lubricating oils	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
Within the Country	13 05 07	Yes	0.0	oily water from oil/water separators	D9	M	Weighed	Offsite in Ireland	Enva Ireland Ltd,196-1	MacAnulty Clear Drains,John F Kennedy Industrial Estate John F Kennedy Road,Naas Road,Dublin 12,Ireland	Enva Ireland Ltd,196-1,MacAnulty Clear Drains,John F Kennedy Industrial Estate John F Kennedy Road,Naas Road,Dublin 12,Ireland	MacAnulty Clear Drains,John F Kennedy Industrial Estate John F Kennedy Road,Naas Road,Dublin 12,Ireland
To Other Countries	13 07 01	Yes	0.0	fuel oil and diesel	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
Within the Country	13 08 99	Yes	0.64	wastes not otherwise specified	R9	M	Weighed	Offsite in Ireland	Rilta Environmental,W0192-03	Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland	Rilta Environmental,W0192-03,Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland	Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland
To Other Countries	15 02 02	Yes	0.0	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
To Other Countries	16 05 04	Yes	0.0	gases in pressure containers (including halons) containing dangerous substances	D10	M	Weighed	Abroad	Indaver Ireland Limited,W0036-02	Tolka Quay Road,Dublin Port,D1,D1,Ireland	Abfall Verwertungs Gesellschaft Gmb (AVG),IB2234/AVG-GENB-2,Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany	Borsigstr. 2,D-22113 Hamburg,Hamburg,D-22113 Hamburg,Germany
Within the Country	16 10 01	Yes	0.0	aqueous liquid wastes containing dangerous substances	D9	M	Weighed	Offsite in Ireland	Rilta Environmental,W0192-03	Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland	Rilta Environmental,W0192-03,Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland	Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland
Within the Country	16 10 02	No	88.71	aqueous liquid wastes other than those mentioned in 16 10 01	D9	M	Weighed	Offsite in Ireland	EPS Dundalk and Drogheda WWTW,EPS Pumping & Treatment Systems	Dundalk WWTW,Lower point road,Co-Louth,Co-Louth,Ireland		
Within the Country	16 10 02	No	0.0	aqueous liquid wastes other than those mentioned in 16 10 01	D9	M	Weighed	Offsite in Ireland	Rilta Environmental,W0192-03	Block 402,Greenogue Business Park,Rathcoole,Dublin,Ireland		
Within the Country	17 02 01	No	0.0	wood	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	17 04 05	No	0.0	iron and steel	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	17 05 04	No	0.0	soil and stones other than those mentioned in 17 05 03	D15	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	17 06 04	No	0.0	insulation materials other than those mentioned in 17 06 01 and 17 06 03	D15	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	17 09 04	No	13.322	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	19 01 02	No	0.0	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	Hammond Lane Metal Company Limited,WFP-DC-0013-01	Pigeon House Road,Ringsend,Dublin 4,Ringsend,Ireland		
Within the Country	19 01 02	No	0.0	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	Clearcircle Metals (Limerick) Limited,WFP-LC+KC-11-001-01	Ballysimon Road,Ballysimon Road,Limerick,Limerick,Ireland		
Within the Country	19 01 02	No	0.0	ferrous materials removed from bottom ash	R12	M	Weighed	Offsite in Ireland	AES t/a Midland Waste Disposal Company Limited,W0131-02	Cloncreggadden,Proudstown,Navan,Co.Meath,Ireland		
Within the Country	19 01 02	No	0.0	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	Multimetal Recycling,WFP-WW-10-0019-02	Conway Port Industrial Estate,Bollarney,Murrough,Wicklow,Ireland		
To Other Countries	19 01 02	No	0.0	ferrous materials removed from bottom ash	R4	M	Weighed	Abroad	Indaver NV,MLAV1/9800000485/MV/bd	Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium		
Within the Country	19 01 02	No	2822.76	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	United Metals,WFP LK 2013 1474 R1	Eastway Business Park,Ballysimon,Ballysimon,Limerick,Ireland		
Within the Country	19 01 02	No	0.0	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	Milton Waste Recycling Limited,WFP CN-15-003-01	Killagh,Crossreagh,Ballyjamesduff,Cavan,Ireland		
To Other Countries	19 01 07	Yes	7276.01	solid wastes from gas treatment	R5	M	Weighed	Abroad	K&S Kali GmBH,LicenceM76D310/57	Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269,Germany	K&S Kali GmBH,LicenceM76D310/57,Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269 Philippsthal,Germany	Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269 Philippsthal,Germany
To Other Countries	19 01 07	Yes	24.68	solid wastes from gas treatment	D9	M	Weighed	Abroad	Indaver NV,MLAV1/9800000485/MV/bd	Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium	Indaver NV,MLAV1/9800000485/MV/bd ,Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium	Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium
To Other Countries	19 01 07	Yes	29.96	solid wastes from gas treatment	R5	M	Weighed	Abroad	K&S,34/Hef-79 n 330-51/153	Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany	K & S,34/Hef-79 n 330-51/153,Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany	Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany
To Other Countries	19 01 07	Yes	1839.88	solid wastes from gas treatment	R11	M	Weighed	Abroad	K&S Kali GmbH Werk Werra,AZ 1325/99 4260/11/99	Standort Unterbreizbach,Untertageverwertung Schacht 11,Unterbreizbach,D36414,Germany	K&S Kali GmbH Werk Werra,AZ 1325/99 4260/11/99,Standort Unterbreizbach,Untertageverwertung Schacht 11,Unterbreizbach,D36414,Germany	Standort Unterbreizbach,Untertageverwertung Schacht 11,Unterbreizbach,D36414,Germany
Within the Country	19 01 12	No	0.0	bottom ash and slag other than those mentioned in 19 01 11	D1	M	Weighed	Offsite in Ireland	Whiteriver Landfill[Louth County Council] ,W0060-03	Whiteriver and Gunstown Townland ,Dunleer,Co-Louth,Co-Louth,Ireland		
Within the Country	19 01 12	No	19861.38	bottom ash and slag other than those mentioned in 19 01 11	D1	M	Weighed	Offsite in Ireland	Scotchcorner Landfill Monaghan County Council,W0020-02	Lisfearbane,Annalla,Castleblayney,Co-Monaghan,Ireland		
Within the Country	19 01 12	No	423.7	bottom ash and slag other than those mentioned in 19 01 11	R11a	M	Weighed	Offsite in Ireland	Greenstar Holdings Limited,W0165-02	Ballynagran Residual Landfill,Ballynagran,Coolbeg and Kilcandra,Wicklow,Ireland		
Within the Country	19 01 12	No	52.32	bottom ash and slag other than those mentioned in 19 01 11	R11a	M	Weighed	Offsite in Ireland	Drehid Landfill(Bord Na Mona PLC),W201-03	Drehid Landfill(Bord Na Mona PLC),Killinagh Upper,Carbury,Co-Kildare,Ireland		
To Other Countries	19 01 13	Yes	27.34	fly ash containing dangerous substances	D9	M	Weighed	Abroad	Indaver NV,MLAV1/9800000485/MV/bd	Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium	Indaver NV,MLAV1/9800000485/MV/bd ,Industriele Afvalverwerking,Poldervlietweg,B-2030 Antwerpen 3,B-2030 Antwerpen 3,Belgium	.,.,.,.,Belgium
To Other Countries	19 01 13	Yes	0.0	fly ash containing dangerous substances	R5	M	Weighed	Abroad	K&S Kali GmBH,LicenceM76D310/57	Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269,Germany	K&S Kali GmBH,LicenceM76D310/57,Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269 Philippsthal,Germany	Reutilisation Salt Mines(Phillippstaal),Nipper StraBe 33,36269 Philippsthal,36269 Philippsthal,Germany
To Other Countries	19 01 13	Yes	1803.46	fly ash containing dangerous substances	R5	M	Weighed	Abroad	K&S,34/Hef-79 n 330-51/153	Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany	K & S,34/Hef-79 n 330-51/153,Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany	Werk Werra,Standort Wintershall Herfagrund,36266 Herfa ,36266 Herfa ,Germany
To Other Countries	19 01 13	Yes	103.81	fly ash containing dangerous substances	D12	M	Weighed	Abroad	K & S ,34/Hef-79n330-51/153	Werra Plant Underground Waste Disposal Plant,Herfa-Neurode,36266 Heringen ,36266 Heringen ,Germany	K & S ,34/Hef-79n330-51/153,Werra Plant Underground Waste Disposal Plant,Herfa- Neurode,36266 Heringen ,36266 Heringen ,Germany	Werra Plant Underground Waste Disposal Plant,Herfa-Neurode,36266 Heringen ,36266 Heringen ,Germany
To Other Countries	19 12 03	No	361.6	non-ferrous metal	R4	M	Weighed	Abroad	CRAENHALS METAL TERMINAL,10088	Van Patraestraat 90 ,2660 HOBOKEN (Antwerpen),Antwerp,2660,Belgium		
To Other Countries	19 12 03	No	190.02	non-ferrous metal	R4	M	Weighed	Abroad	Galloo,IHM-AFVAL4024	Wervikstraat 320,8930 Menen,Menen,8930,Belgium		
Within the Country	20 01 36	No	0.29	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	20 01 38	No	6.96	wood other than that mentioned in 20 01 37	R12	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	20 01 39	No	0.0	plastics	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	20 03 01	No	0.0	mixed municipal waste	R13	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	20 03 01	No	0.0	mixed municipal waste	D15	M	Weighed	Offsite in Ireland	Nurendale Limited trading as Panda Waste Services Limited,W0140 - 03	Rathdrinagh,Beauparc,Navan ,Co Meath ,Ireland		
Within the Country	20 03 01	No	5.2	mixed municipal waste	R1	E	Volume Calculation	Onsite of generatio	Indaver Ireland Limited,W0167-02	Carranstown,Duleek,Co-Meath,N/A,Ireland		
Within the Country	20 03 03	No	0.0	street-cleaning residues	R1	M	Weighed	Onsite of generatio	Indaver Ireland Limited,W0167-02	Carranstown,Duleek,Co-Meath,N/A,Ireland		
Within the Country	20 03 04	No	18.0	septic tank sludge	D9	M	Weighed	Offsite in Ireland	EPS Dundalk and Drogheda WWTW,EPS Pumping & Treatment Systems	Dundalk WWTW,Lower point road,Co-Louth,Co-Louth,Ireland		
Within the Country	20 03 04	No	100.33	septic tank sludge	D9	M	Weighed	Offsite in Ireland	Dublin City Council Ringsend Waste Water Treatment Plant,D0034-01	Drainage Services Environmental and Engineering Dept,Civic Office,Wood Quay,Dublin 8,Ireland		
Within the Country	20 03 07	No	0.0	bulky waste	D1	M	Weighed	Offsite in Ireland	Whiteriver Landfill[Louth County Council] ,W0060-03	Whiteriver and Gunstown Townland ,Dunleer,Co-Louth,Co-Louth,Ireland		
Within the Country	16 10 02	No	0.0	aqueous liquid wastes other than those mentioned in 16 10 01	D9	M	Weighed	Offsite in Ireland	Dublin City Council Ringsend Waste Water Treatment Plant,D0034-01	Drainage Services Environmental and Engineering Dept,Civic Office,Wood Quay,Dublin 8,Ireland		
To Other Countries	19 12 03	No	143.6	non-ferrous metal	R4	M	Weighed	Abroad	Recco Non Ferro Metals BV,OLO Number 1016711	Montage Weg 2,8304 BG Emmeloord,Emmeloord,.,Netherlands		
Within the Country	19 01 12	No	15228.332	bottom ash and slag other than those mentioned in 19 01 11	R11a	M	Weighed	Offsite in Ireland	Greenstar Knockharley,W0146-01	Knockharley,Navan,Co-Meath,.,Ireland		

Link to previous years waste data
Link to previous years waste summary data & percentage change
Link to Waste Guidance

From: aerreturns@epa.ie Sent: Tue 28/03/2017 03:03
To: Grace McCormack
Cc:
Subject: AER / PRTR Emissions Data VERIFICATION OF ACCEPTANCE (W0167_2016.xml)

Thank you,

Your AER / PRTR Emissions Data submission has been accepted by our data system.

You may now proceed to save your submitted emissions and waste transfers information in a format suitable for insertion into your Full AER report. The Full AER Report must be submitted in electronic (PDF) form only, the AER is NOT required in hardcopy (paper) form.

Please retain the receipt / tracking number below in case of future queries about this submission and in case a request is made by an authorised person in this regard.

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Appendix 2: Energy Efficiency Report

Indaver Ireland

Energy Audit

Waste Licence W0167-03

2016 Energy Audit

Introduction

This document reflects the licence requirement in Condition 7.1.3 to demonstrate the energy efficiency of the site. Energy Efficiency must be, as a minimum, 0.65. This document reports the result of 0.72.

Audit

Audit period

1st January 2016 to 31st December 2016.

Audit personnel

The persons involved in the audit were the Process Engineer Joe Crawley, the Maintenance Manager, Rory Murphy, Electrical and Instrumentation Supervisor Eoin Wright and the Quality and Environmental Manager, Grace McCormack.

Scope of audit

The scope of the required energy audit is as defined by the 'Guidance Note on Energy Efficiency Auditing', published by the EPA, Johnstown Castle, Co. Wexford, Ireland.

Additional requirements re the energy audit are contained in Condition 7.1.2 and Condition 7.1.3 of the Waste Licence. The scope of the audit includes these conditions which reads as follows:

> 7.1.2 The licensee shall build and operate the facility to achieve an energy efficiency of, as a minimum, 0.65 using the formulae below to calculate Energy Efficiency:
>
> Energy Efficiency = [Ep– (Ef + Ei)]/0/97 x (Ew + Ef] where
>
> Emission point = annual energy produced as heat or electricity (GJ/year) (heat produced for commercial use is multiplied by 1.1 and electricity is multiplied by 2.6)
>
> Ef = annual energy input to the system from fuels contributing to the production of steam (GJ/year)
>
> Ew = annual energy contained in the waste input using the net calorific value of the waste (GJ/year)

Energy Efficiency

Condition 7.1.2 of the Waste Licence sets minimum energy efficiency. The achievement of this parameter is reviewed.

Energy Performance

Condition 7.1.3 requires a calculation to be determined for the net usable energy produced per tonne of waste. This calculation was performed and the result is as shown:

Net Usable Energy Per Tonne of Waste Processed	0.64 M Wh/Tonne

Condition 7.1.3 also requires a full breakdown of the calculation of each parameter in the equation and the results for this is shown below:

$$\text{Energy efficiency} = \frac{E_p - (E_f + E_i)}{0.97 * (E_w + E_f)}$$

In which:

E_p means annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/year)

E_f means annual energy input to the system from fuels contributing to the production of steam (GJ/year)

E_w means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)

E_i means annual energy imported excluding E_w and E_f (GJ/year)

***0.97** is a factor accounting for energy losses due to bottom ash and radiation*

In addition, Annex II of the WFD highlights that this formula shall be applied in accordance with the Reference Document on Best Available Techniques for Waste Incineration (BREF WI).

Data used: 1st January 2016 to 31st December 2016.

	Total waste treated 01/01/16 to 31/12/16	229122	**Tonnes**		
	Total electricity produced 01/01/16 to 31/12/16	146550	**MWh**		
	Type of energy	**Unit**	**Tonne**	**NCV (kJ/kg)**	**Energy (MWh)**
1.1	Adjusted amount incinerated waste		226,327	9,568	601,528
1.2	**E_w Energy input of waste**	**MWh**			**601,528**
1.3	Ef: Light fuel oil used for startup / keeping temperature	tonne	120.52	42,000	1,406
2	Ef: Natural gas used		-	-	-
2.1 + 2.2	**Ef: Energy input by imported energy with steam**	**MWh**			**1,406**
2.3	Ei: Light fuel oil used for startup / shutdown	tonne	120.52	42,000	1,406
3	Ei: Natural gas used	-	-	-	-
3.1	Ei: imported electricity (multiplied with equivalence factor 2.6)	-	-	-	
3.2	Ei: imported heat	-	-	-	-
3.3	**Ei: Energy input by imported energy without steam**	**MWh**			**1,406**
3.4	Ep: Adjusted electricity produced and internally used for incineration process	MWh	18,037.00	-	
4	Ep: electricity delivered to a third party	MWh	128,514.00	-	
4.1	**Ep: Electricity produced adjusted for curtailment**	**MWh**	**145,926.28**		**145,926.28**
4.2	Ep: Heat exported	MWh	-	-	-
5	**Ep: Heat exported**	**MWh**	**-**	**-**	**-**
5.1 + 5.2	Ep: heat used internally for steam driven pumps, backflow, heating flue gas, liquid APC residues		-	-	-
6	Ep: for soot blowing without backflow		-	-	
6.1 to 6.3	Ep: for heating buildings, deaeration, NH4OH injection		-	-	-
6.4	**Ep: Heat used internally**	**MWh**	**-**	**-**	**-**
6.5 to 6.7	**Ep**	**MWh**			**379,408**
7	**R1**				**0.720**

R1 Adjustments: Curtailment

Objective:	Omit periods where NCC constrains / curtails plant as energy must be spilt during these periods.
Data affected:	MWh produced, waste tonnes processed
Obtaining data:	MWh produced and waste treated during constraints from NCC
affect of data	Tonnes of waste in 1.1 reduced to exclude contraint periods
	Ep Electrity produced in 5 reduced by electricity producted during contraint

Frequency of processsing data: monthly

Curtailment

	MWh	t waste
Jan-16	9.863	28
Feb-16	69.32	301
Mar-16	36.431	150
Apr-16		
May-16	53.539	313
Jun-16	34.15	205
Jul-16		
Aug-16	42.288	127
Sep-16	131.306	510
Oct-16	15.721	71
Nov-16	61.572	230
Dec-16	169.53	859
Total	**623.7**	**2794.6**

Energy Auditing Scheme Report

for

Revision Control

Energy Consultants	PowerTherm SOLUTIONS Rockhill, Main Street, Blackrock, Co.Dublin Phone - +353 1 278 4388 Email - info@powertherm.ie www.powertherm.ie *Energy Consultants - Project Managers - Energy and Maintenance Managers*
Document Title:	EAS Report
Revision number:	170320
Status:	Final (comments incorporated)
Issue Date:	20th March 2017
Prepared by:	Steven Roycroft
Checked by:	Cian O'Riordan
Supporting Spreadsheets (retained by PowerTherm)	161108 Indaver calculation spreadsheet

Executive Summary

This Energy Audit has been prepared for Indaver Ireland Ltd to ensure compliance with S.I. 426 (2014), which requires large enterprises to carry out an Energy Audit of their operations every four years.

Indaver provide waste management solutions to large scale industry and public authorities, including the operation of a Waste-to-Energy plant located in Meath which treats more than 200,000 tonnes of municipal solid waste every year.

S.I. 426 states that "Companies that are not SMEs shall carry out an energy audit…" Indaver is not an SME and so is undertaking an audit of the facilities it owns or occupies. In 2015 Indaver owned the following facilities and vehicles, which fall within the scope of this energy audit:

- Cork Office, South Ring Business Park
- Dublin Office, Dun Laoghaire
- Dublin Port Waste Transfer Station
- Meath WTE Plant
- Civic Amenity Centre, Newcastlewest
- Civic Amenity Centre, Glenfield
- Civic Amenity Centre, Bunlicky
- Company Car Fuel Use

The audit must include 70% of total primary energy use in order to comply. This includes all forms of energy used, including transport fuel. In this instance MSW is included as energy used by Indaver. The below table summarises the energy used in each area.

Final Energy Consumpton 2015 (kWh)	Electricity	Natural Gas	Propane	Diesel	Petrol	MSW[1]	Total	Comments
Cork Office	45,936	8,411		26,554	427		**81,328**	
Dublin Office	57,276	72,348		106,833	4,025		**240,482**	Utility use based on CIBSE floor area benchmark
Dublin Port	412,925			6,922	11,940		**431,787**	
WTE Plant	17,755,000		69,907	2,342,673	389	600,135,876	**620,303,845**	Elec use is considered as total consumed onsite
Newcastlewest	12,827						**12,827**	Annualised based on 10 months of data
Kilmallock	10,050						**10,050**	Annualised based on 10 months of data
Bunlicky	20,846						**20,846**	Annualised based on 10 months of data
Other Vehicles				709,610			**709,610**	Vehicles unassigned to a location
Total	**18,314,860**	**80,759**	**69,907**	**3,192,592**	**16,781**	**600,135,876**	**621,810,775**	

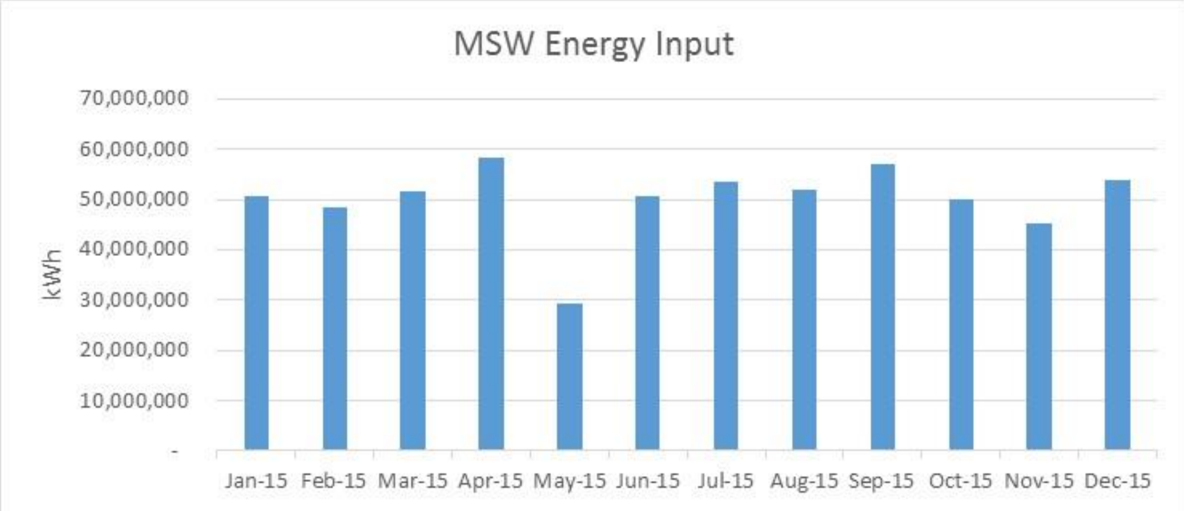
1 - Municipal Solid Waste burned in the incinerator

Primary energy includes the energy requirements for the conversion of primary sources of energy into forms that are useful for the final consumer, for example electricity generation and oil refining. From the initial analysis it was found the Meath WTE plant uses over 99% of Invader's energy use. It was thus concluded that the scope of the assessment would be limited to the WTE plant.

In 2015 the energy used by Indaver resulted in 70,621 tonnes of CO_2 being emitted.

Analysis of Energy Use

As the facility runs 24x7, its energy inputs and outputs are relatively constant. The MSW is mixed in the bunker to ensure an even calorific value is maintained going into the furnace. The below chart shows the monthly breakdown of the MSW energy input into the system.



The site is capable, and has an license to export 19MW of electricity at any time. Although the turbine generates 21MW, there are site loads of approximately 2MW which reduce the export amount.

As the process of incineration is a specialist area the focus of the audit was around the balance of plant, in an effort to reduce the site load consumption.

Energy Savings and Conservation Measures

At the early stages of the audit process, meetings were conducted with site staff to establish areas where scope for energy savings may be possible and to develop a better understanding of the operation of the facility. Much of the opportunities explored were outside of the core process, in areas where there was better scope to implement changes. The areas of focus which were agreed upon were:

- Heat recovery of boiler blowdown steam
    - Steam is blown down to control the level of contaminates in the boiler. The heat from this steam could be recovered and used to preheat boiler feed water
- Compressed air opportunities
    - Quantify benefits of reducing supply pressure setpoint
        - Every 1 bar in pressure reduction produces a 6 – 7 % power saving
    - Quantify costs of drying air with subsequent recommendations for improvements
        - The refrigerated dryers are doing 11% of their rated capacity but they are using 65% of their rated power, indicating they have a very poor part load energy performance. The measured specific power consumption of the dryer as it is currently configured is 1.7 kW/m^3/min. Their rated specific power consumption is 0.16 kW/m^3/min. Allowing a single dryer to handle the air volume requirements would significantly reduce electricity consumption
        - It was found that 36% of the compressors air output is used to purge the regenerating tower of the desiccant dryer due to the fact that they are so oversized. The measured specific power consumption of the desiccant dryer as it is currently configured is 9.18 kW/m^3/min. Their rated specific power consumption is 0.98 kW/m^3/min at current system pressure. A smaller dryer should be installed, or a dryer that uses the hot discharge gas of the compressor to regenerate the tower could be purchased
    - Investigate effects of exhaust and intake air short circuiting on compressor performance

        - A 1% reduction in compressor power consumption can be achieved through a 4 °C reduction in inlet temperature. The air entering the compressors are significantly hotter than the ambient air and ductwork modifications are required to remedy this
    - Heat recovery possibilities
        - Up to 85% of the electrical energy supplied to a compressor can be recovered as heat. This could be recovered to preheat boiler feed water
- Free cooling in the VSD MCC Room
    - Due to the moderate climate in Ireland, free cooling is possible for a high % of the year. Ambient air could be used to cool the room when temperatures are below 16°C which is approximately 80% of the time
- Improved control of turbine hall extractor fan
    - The fan could be used to maintain a room setpoint temp, rather than running at a fixed speed. During colder months this would result in savings and the infrastructure to implement the measure is already in place
- Control of Admin Building AHU
    - Many control issues were found during the audit. The heating coil appears to be on at the same time as the cooling coil. The heat being recovered from the boiler hall could be increased. The AHU runs 24x7 and at night there is only the control room which is occupied – local ventilation and heating should be considered. The return fan speed should be ramped rather than using the bypass damper to achieve fan savings. Changes in supply setpoint control and deadbands were suggested. See section 3.3.8. for more detail
- LED lighting and controls upgrades
    - Significant savings could be achieved by upgrading the 400W SON and T8 fittings to LED with daylight controls where appropriate

There were 2no. site visits conducted to investigate these opportunities, take measurements and where appropriate log electricity power usage of specific pieces of equipment. The detailed analysis can be found in the body of the report, but below summaries the energy and cost savings calculated.

	Annual Energy Use	Potential Savings	% Savings	Cost Savings	Budget Cost	Simple Payback
	kWh elec	kWh elec	%	€	€	Years
Heat Recovery from Boiler Blowdown	2,861,050	2,506,775	87.6%	€ 67,285	TBC	
Compressed Air - Reduce Supply Pressure Setpoint	654,810	40,296	6.2%	€ 3,425	€ -	Immediate
Compressed Air - Dryer Energy Saving	319,722	274,589	85.9%	€ 23,340	TBC	
Compressed Air - Exhaust and Intake Air Cross Circuiting	654,810	15,388	2.4%	€ 1,308	€ 17,500	13.4
Compressed Air - Heat Recovery	625,098	500,078	80.0%	€ 13,423	TBC	
VSD MCC Room Free Cooling	141,309	113,434	80.3%	€ 9,642	€ 50,000	5.2
Turbine Hall Extract Fan Control	157,680	81,468	51.7%	€ 6,478	€ -	Immediate
Admin Building AHU Controls		116,360		€ 9,891	€ 15,000	1.5
LED Lighting and Controls Upgrade	654,012	454,822	69.5%	€ 38,660	€ 59,000	1.5
Total		4,103,210		€ 173,451		

Note that as some of the measures involved specialist items of equipment budget costs could not be established for all measures.

CEO/Senior Director Sign Off

Signature:

Name: Conor Jones

Position: Regional Engineering Director

Date: 24/03/2017

Table of Contents

1. Introduction

This Energy Audit has been prepared for Indaver Ireland Ltd to ensure compliance with S.I. 426 (2014), which requires large enterprises to carry out an Energy Audit of their operations every four years, with the first such audit being completed by 5th December 2015.

This Energy Audit is based on energy data for the 2015 calendar year.

All euro figures exclude VAT.

1.1. Corporate Structure & Scope of Audit

Indaver provide waste management solutions to large scale industry and public authorities, including the operation of a Waste-to-Energy plant located in Meath which treats more than 200,000 tonnes of municipal solid waste every year.

S.I. 426 states that "Companies that are not SMEs shall carry out an energy audit…" Indaver is not an SME and so is undertaking an audit of the facilities it owns or occupies. In 2015 Indaver owned the following facilities and vehicles, which fall within the scope of this energy audit:

- Cork Office, South Ring Business Park
- Dublin Office, Dun Laoghaire
- Dublin Port Waste Transfer Station
- Meath WTE Plant
- Civic Amenity Centre, Newcastlewest
- Civic Amenity Centre, Glenfield
- Civic Amenity Centre, Bunlicky
- Company Car Fuel Use

2. Analysis of Energy Consumption & Performance

2.1. Introduction

SEAI has advised that where an organisation is made up of many geographically diverse sites "an overall audit of the operation can be prepared by gathering energy use data for all of the sites. A sample of sites with similar business operations can be audited in order to build a representative picture and this must equate to at least 70% of total primary energy use in order to comply. This type of benchmarking audit can help to identify replicable projects and potential outliers."

This section analyses overall primary energy use in an attempt to identify the appropriate site(s) to undergo detailed audit.

2.2. Facilities and Utility Supply Points

Indaver currently conduct activities at 7 different sites throughout Ireland. The below is a list of those facilities and details of their electricity and/or gas meter reference numbers.

Site	Address	MPRN	GPRN	Notes
Cork Office	Kinsale Road Roundabout, Cork	10006211700	951715	
Dublin Office	West pier, old Dun Leary road, Dun Laoghaire			Office sublet in multi tenant building
Dublin Port Waste Transfer Station	Tolka Quay Road, Dublin port	10001059391	NA	
Meath WTE Plant	Carranstown, Duleek, Co-Meath		NA	Power station
Civic Amenity Centre Newcastlewest	Station Road, Templegreen, Newcastlewest, Co. Limerick	10019039383	NA	
Civic Amenity Centre, Kilmallock	Shannon Development Ind Estate, Bruree Road, Co.Limerick	10020644405	NA	
Civic Amenity Centre, Bunlicky	Bunlicky, Mungret, Co.Limerick	10301998411	NA	

The Dublin Office is a single floor of a multi-tenant building and the utility consumption is not sub-metered and is charged on a pro rata basis. Therefore there are no meter reference numbers associated with it.

2.3. Final Energy Consumption

Final Energy Consumpton 2015 (kWh)	Electricity	Natural Gas	Propane	Diesel	Petrol	MSW[1]	Total	Comments
Cork Office	45,936	8,411		26,554	427		**81,328**	
Dublin Office	57,276	72,348		106,833	4,025		**240,482**	Utility use based on CIBSE floor area benchmark
Dublin Port	412,925			6,922	11,940		**431,787**	
WTE Plant	17,755,000		69,907	2,342,673	389	600,135,876	**620,303,845**	Elec use is considered as total consumed onsite
Newcastlewest	12,827						**12,827**	Annualised based on 10 months of data
Kilmallock	10,050						**10,050**	Annualised based on 10 months of data
Bunlicky	20,846						**20,846**	Annualised based on 10 months of data
Other Vehicles				709,610			**709,610**	Vehicles unassigned to a location
Total	**18,314,860**	**80,759**	**69,907**	**3,192,592**	**16,781**	**600,135,876**	**621,810,775**	

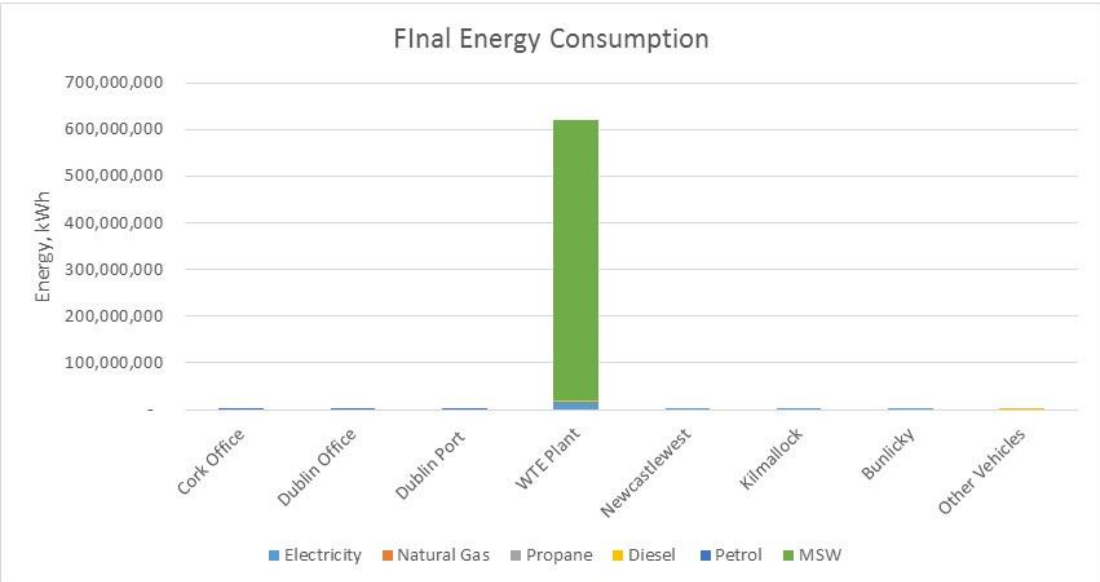
1 - Municipal Solid Waste burned in the incinerator

The propane, diesel and petrol usage was broken out per site where possible. Not every vehicle was based at a particular site and so the usage associated with these were designated as 'Other Vehicles'.

The utility usage for the Dublin office was estimated based on its floor area which was obtained from floor plan drawings[1] and CIBSE benchmark figures[2] as follows. The landlord could not provide the energy consumption details that were requested so this approach was taken.

Office area	602.9	m^2
Electricity typical Benchmark	95	kWh/m^2
Fossil Fuel typical Benchmark	120	kWh/m^2
Estimated Electricity Use	**57,276**	kWh
Estimated Gas Use	**72,348**	kWh

A stacked bar chart showing the energy used per site can be seen as follows.



1 Drawing number 5923-001 – BKD Architects
2 Energy benchmarks, TM46:2008, Table 1(b)

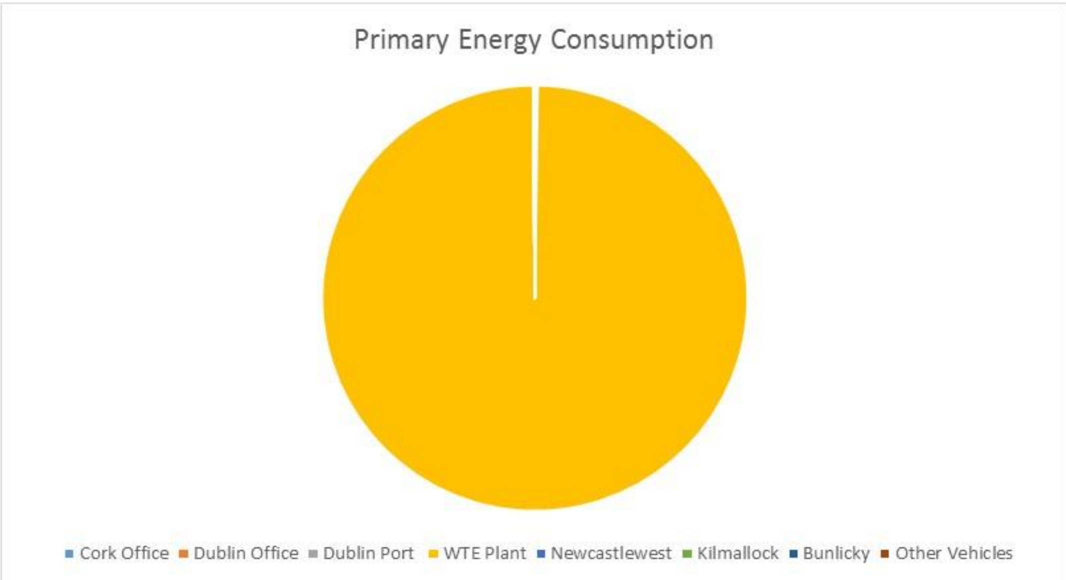
2.4. Primary Energy Consumption

Under the EU Energy Efficiency Directive (2012/27/EU) that has been imposed into Irish Law through the guidance of the Sustainable Energy Authority of Ireland (SEAI), it is required that the Energy Audit must cover at least 70% of the Primary Energy Consumption. Primary Energy consumption evaluates the energy that is consumed at the source and the energy needed to transport to the end user. For the generation and transmission of electricity, losses are incurred at the generation station and in the losses of transmitting the electricity through the network. As generating station and transmission distribution become more efficient, the losses are reduced.

The Final Energy Consumption of Electricity, Gas and Diesel, when multiplied by the primary energy conversion factors[3] results with the Primary Energy Consumption breakdown as tabulated below.

Primary Energy Consumpton 2015 (kWh)	Electricity	Natural Gas	Propane	Diesel	Petrol	MSW	Total	Comments
Cork Office	100,140	9,252	-	26,554	427	-	**136,374**	
Dublin Office	124,861	79,583	-	106,833	4,025	-	**315,302**	Utility use based on CIBSE floor area benchmark
Dublin Port	900,177	-	-	6,922	11,940	-	**919,039**	
WTE Plant	38,705,900	-	69,907	2,342,673	389	600,135,876	**641,254,745**	Elec use is considered as total consumed onsite
Newcastlewest	27,962	-	-	-	-	-	**27,962**	Annualised based on 10 months of data
Kilmallock	21,909	-	-	-	-	-	**21,909**	Annualised based on 10 months of data
Bunlicky	45,445	-	-	-	-	-	**45,445**	Annualised based on 10 months of data
Other Vehicles	-	-	-	709,610	-	-	**709,610**	Vehicles unassigned to a location
Total	**39,926,394**	**88,835**	**69,907**	**3,192,592**	**16,781**	**600,135,876**	**643,430,385**	

The above table and below chart shows that the Meath Waste to Energy plant consumes over 99% of the primary energy used by Indaver in Ireland. It was therefore concluded that the scope of the audit would be limited to this location.



[3] Source: SEAI

2.5. Energy Costs

Energy costs are tabulated below.

Energy Cost 2015 (€)	Electricity	Natural Gas	Propane	Diesel	Petrol	MSW	Total	Comments
Cork Office	€ 8,268	€ 378	€ -	€ 3,135	€ 60		€ **11,842**	
Dublin Office	€ 10,310	€ 3,256	€ -	€ 12,612	€ 565		€ **26,742**	Utility use based on CIBSE floor area benchmark
Dublin Port	€ 74,327	€ -	€ -	€ 817	€ 1,675		€ **76,818**	
WTE Plant	€ 1,509,175	€ -	€ 8,389	€ 276,558	€ 55	€ -	€ **1,794,176**	MSW is not purchased
Newcastlewest	€ 2,309	€ -	€ -	€ -	€ -		€ **2,309**	Annualised based on 10 months of data
Kilmallock	€ 1,809	€ -	€ -	€ -	€ -		€ **1,809**	Annualised based on 10 months of data
Bunlicky	€ 3,752	€ -	€ -	€ -	€ -		€ **3,752**	Annualised based on 10 months of data
Other Vehicles	€ -	€ -	€ -	€ 83,771	€ -		€ **83,771**	Vehicles unassigned to a location
Total	**€ 1,609,950**	**€ 3,634**	**€ 8,389**	**€ 376,892**	**€ 2,354**	**€ -**	**€ 2,001,219**	

Note MSW is not purchased as a fuel and so its value has been left blank.

The assumed Average Utility Prices (AUPs) used to establish costs are as follows:

Fuel Types	AUP (€/kWh)	Notes
WTE Plant Elec	0.085	advised by client
General Elec	0.18	SEAI commerical fuel cost comparision Oct 2016
Gas	0.045	SEAI commerical fuel cost comparision Oct 2016
Propane	0.12	SEAI commerical fuel cost comparision Oct 2016
Diesel	0.12	Based on cost per L of €1.2
Petrol	0.14	Based on cost per L of €1.3

The AUP for electricity generated and used on the Meath site has a value of 0.085 €/kWh as this is the average price paid for export of electricity, as advised by the client. This electricity is not bought from the grid, hence the lower value.

2.6. Greenhouse Gas (CO_2) Emissions

Greenhouse gases are produced in the generation of electricity and the combustion of other fuels. This contributes to global warming. The below table shows the amount of greenhouse gases produced by Indaver in Ireland.

Emissions 2015 (Tonnes CO_2)	Electricity	Natural Gas	Propane	Diesel	Petrol	MSW	Total	Comments
Cork Office	21.0	1.7	-	7.0	0.1		**29.8**	
Dublin Office	26.2	14.8	-	28.2	1.0		**70.2**	Utility use based on CIBSE floor area benchmark
Dublin Port	188.5	-	-	1.8	3.0		**193.4**	
WTE Plant	8,106.9	-	8.4	618.2	0.1	61,387.6	**70,121.2**	MSW is based on elec export of 134,445,000 kWh
Newcastlewest	5.9	-	-	-	-		**5.9**	Annualised based on 10 months of data
Kilmallock	4.6	-	-	-	-		**4.6**	Annualised based on 10 months of data
Bunlicky	9.5	-	-	-	-		**9.5**	Annualised based on 10 months of data
Other Vehicles	-	-	-	187.3	-		**187.3**	Vehicles unassigned to a location
Total	**8,362.6**	**16.5**	**8.4**	**842.5**	**4.2**	**61,387.6**	**70,621.8**	

Note that there was no emissions factor available from SEAI for the combustion of MSW at the time of writing. In order to arrive at a figure for MSW emissions the total amount of electricity exported was used and multiplied by the relevant factor.

The emissions factors used are as follows:

Fuel Types	kg CO_2/kWh	Notes
Electricity (2014)	0.457	SEAI Emissions Factors
Gas	0.205	SEAI Emissions Factors
Propane	0.229	SEAI Emissions Factors
Diesel	0.264	SEAI Emissions Factors
Petrol	0.252	SEAI Emissions Factors

2.7. Scope of Detailed Survey

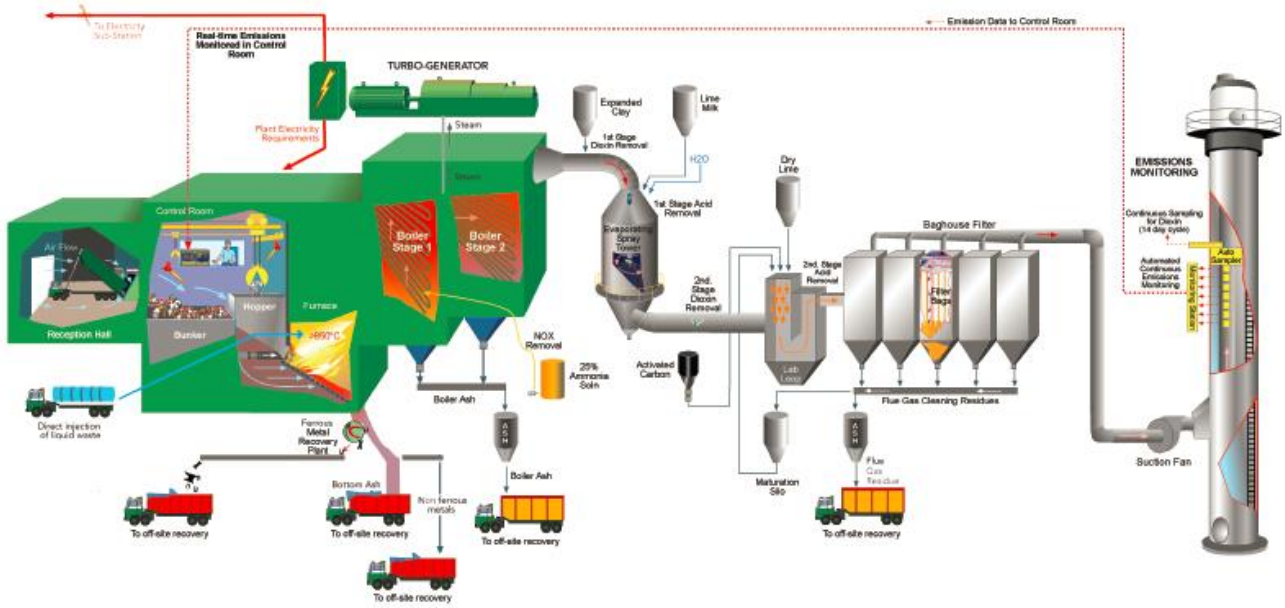
The guidance supplied by the SEAI for conducting an Energy Audit is that is must cover at least 70% of the total primary energy used by the organization as a whole in order to comply with the law.

Based on the analysis of primary energy use in Section 2.4, it was decided to focus the audit on energy use by the WTE facility in Meath. The energy audit will therefore cover 99% of primary energy.

3. Detailed Energy Survey of the Meath WTE Facility

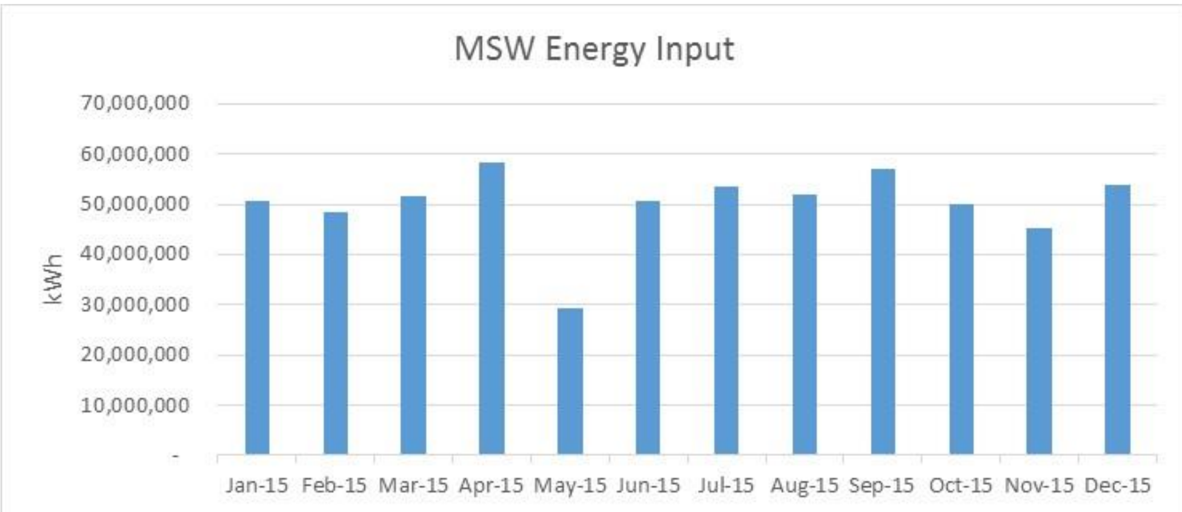
3.1. Introduction

The WTE facility in Duleek, Co. Meath processes approximately 230,000 tonnes of waste on an annual basis and exports 19MW of electricity to the grid, using 2MW on the site on a continual basis (except planned maintenance shutdowns). It treats the waste in a boiler to generate steam to be used in a turbine to produce electricity.



3.2. Analysis of Energy Use

As the facility runs 24x7, its energy inputs and outputs are relatively constant. The MSW is mixed in the bunker to ensure an even calorific value is maintained going into the furnace. The below chart shows the monthly breakdown of the MSW energy input into the system.



The site is capable, and has a license to export 19MW of electricity at any time. Although the turbine generates 21MW, there are site loads of approximately 2MW which reduce the export amount.

As the process of incineration is a specialist area the focus of the audit was around the balance of plant, in an effort to reduce the site load consumption.

3.3. Energy Savings and Conservation Measures

At the early stages of the audit process, meetings were conducted with site staff to establish areas where scope for energy savings may be possible and to develop a better understanding of the operation of the facility. Much of the opportunities explored were outside of the core process, in areas where there was better scope to implement changes. The areas of focus which were agreed upon were:

- Heat recovery of boiler blowdown steam
- Compressed air opportunities
  - Quantify benefits of reducing supply pressure setpoint
  - Quantify costs of drying air with subsequent recommendations for improvements
  - Investigate effects of exhaust and intake air short circuiting on compressor performance
  - Heat recovery possibilities
- Free cooling in the VSD MCC Room
  - Include proposal for hot isle separation
- Improved control of turbine hall extractor fan
- Control of Admin Building AHU
- LED lighting and controls upgrades

Opportunities that were suggested for review but were not thought to be feasible, or practical, or would not add any significant benefit were:

- Speed Control of Well Water Pumps
  - The well pumps are pushing against the ball cock in the main storage tank which is producing a back pressure on the pumps, causing excessive power usage. Controlling the pumps VSDs on a level sensor would be more efficient, however the client felt that the work involved in making changes would be prohibitive. The proposed methodology for testing what the savings might be can be seen in Appendix A.
- Analysis of electricity flows to identify significant energy users
  - It was felt by the client that this would not add any benefit
- DSU participation using backup generator as a dispatchable load
  - Not possible to quantify benefit due to changing electricity market
- Calculate savings from the change of pitch angle on air cooled condenser fans
  - The change was made in advance of the survey starting
- Optimisation and control of ash conveyor system
  - This has already been reviewed by Indaver
- Upgrade of some motors to high efficiency
  - Motors that were installed were highest efficiency available and are only a few years old
- Optimise crane operation in tipping hall
  - Current operation critical to maintaining stable CV of fuel

As there is no electrical sub-metering on the site power logging was conducted on specific items of plant that were under investigation where it added value to the analysis and where practical.

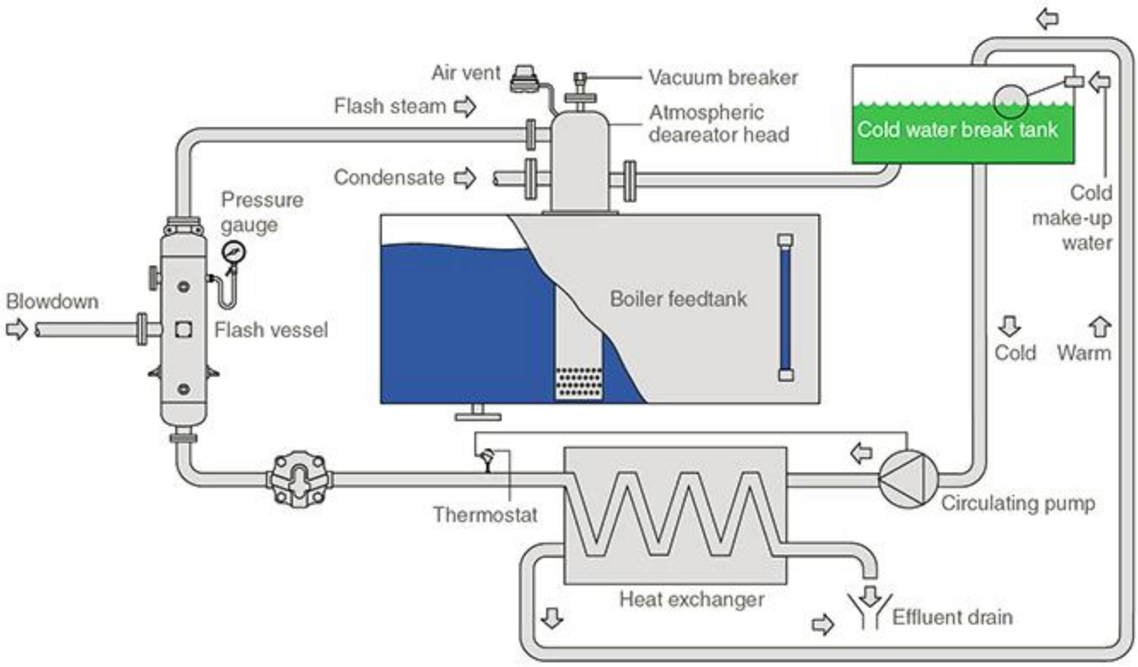
3.3.1. Heat Recovery from Boiler Blowdown

As water is boiled within the boiler, and steam is produced, impurities in the feed water concentrate in the boiler water. The concentration of these impurities is called Total Dissolved Solids (TDS). These impurities need to be removed to ensure good quality dry steam is produced.

There are many ways of controlling the removal of these impurities. Indaver have adopted the method of periodic blowdown for a set time period. Other, more efficient methods involve continual controlled blowdown with a flowrate based on the % of TDS present in the boiler. Generally speaking this results in less steam blowdown over the course of a day as it is based on actual requirements, meaning less heat is sent to drain.

The current regime involves a 10 minute blowdown, three times a day. The blowdown is injected into a flash vessel at 250˚C (50 Barg) where it is mixed with process water until a temperature of 60 ˚C is achieved. The mixed water is then sent to the 'clean water pit'. The associated volumes of water are not all measured and the only detail that is recorded is the total boiler daily makeup water which includes trap losses as well as blowdown. This volume is typically 26,000 litres a day.

Up to 75% of the heat in blowdown water can typically be recovered (50% from the flash stem and 25% from the remaining water)[4]. The flash steam is clean and can be injected back into the boiler feedwater tank and the remaining, hot water can be passed through a heat exchanger to recover heat from it. The below diagram shows an indicative schematic of such an arrangement.



As the blowdown is periodic it is necessary to install a break tank with a circulating pump which is operated on a thermostat to take the heat when it becomes available.

Savings

The SEAI figures are approximate, and a more accurate savings figure can be achieved by using the actual enthalpies of steam at the relevant points in the system.

[4] Source - SEAI

Enthalpy of blowdown at 50barg, 250degC	hf	1,085	kJ/kg		
Enthalpy of water at 1.7 barg	hf	547	kJ/kg		
	hg	2,721	kJ/kg		
	hfg	2,174	kJ/kg		
Enthalpy of water at 0 barg, saturation temp	hf	419	kJ/kg		
Enthalpy of water at 0 barg, 12degC	hf	50	kJ/kg		
% of total blowdown mass flow rate as flash steam		24.8%			
Mass flowrate flash steam		2,349,862	kg/year		
Energy recoverable from flash steam		**1,775,888**	**kWh/year**	**62%**	**of total heat available for recovery**
Mass flowrate of contaminated blowdown water		7,140,138	kg/year		
Energy in contaminated water		419	kJ/kg		
Enthalpy of water at 12deg		50	kJ/kg		
Energy available to heat makeup water		369	kJ/kg		
Energy recoverable from condensate		**730,887**	**kWh/year**	**26%**	**of total heat available for recovery**
Total energy available		2,861,050	kWh/year		
Total energy recoverable		**2,506,775**	**kWh/year**	**88%**	**of total heat available for recovery**

This analysis shows that up to 88% of the blowdown heat can be recovered and used to heat boiler feedwater. To put a value on this it is easier to consider this saving in terms of potential additional generation capacity. Trying to put a value on offset MSW does not work in this situation as Indaver are paid to receive the waste.

The calculated system efficiency (Electricity generated / MSW energy input) for 2015 was 25.3%. To convert heat savings from blowdown to MSW fuel savings a boiler efficiency of 80% was used. The below calculation shows that the system could potentially deliver an additional 791,586 kWh of electricity for the same MSW fuel input.

Electricity generated and used onsite	17,163,000	kWh
Electricity exported	134,445,000	kWh
Total electricity generated	151,608,000	kWh
MSW fuel used	600,135,876	kWh
System efficiency	25.3%	

Heat recovered from blowdown	2,506,775	kWh
Assumed Boiler Efficiency	80%	
Increased potential electrical output	791,586	kWh
Value of increased output	**€ 67,285**	

Estimation of budget costs for this measure are not provided as this is specialised work that Indaver would need to be involved in pricing.

3.3.2. Compressed Air – Reduce Supply Pressure Setpoint

There are 3no. compressors on the site, two of which are fixed speed and one is variable speed. The VSD controlled compressor acts as the lead and is typically 40% loaded.

Every 1 bar in pressure reduction produces a 6 – 7 % power saving[5]. The spec sheet for the variable speed compressor provides details on specific power consumption as per the below chart.

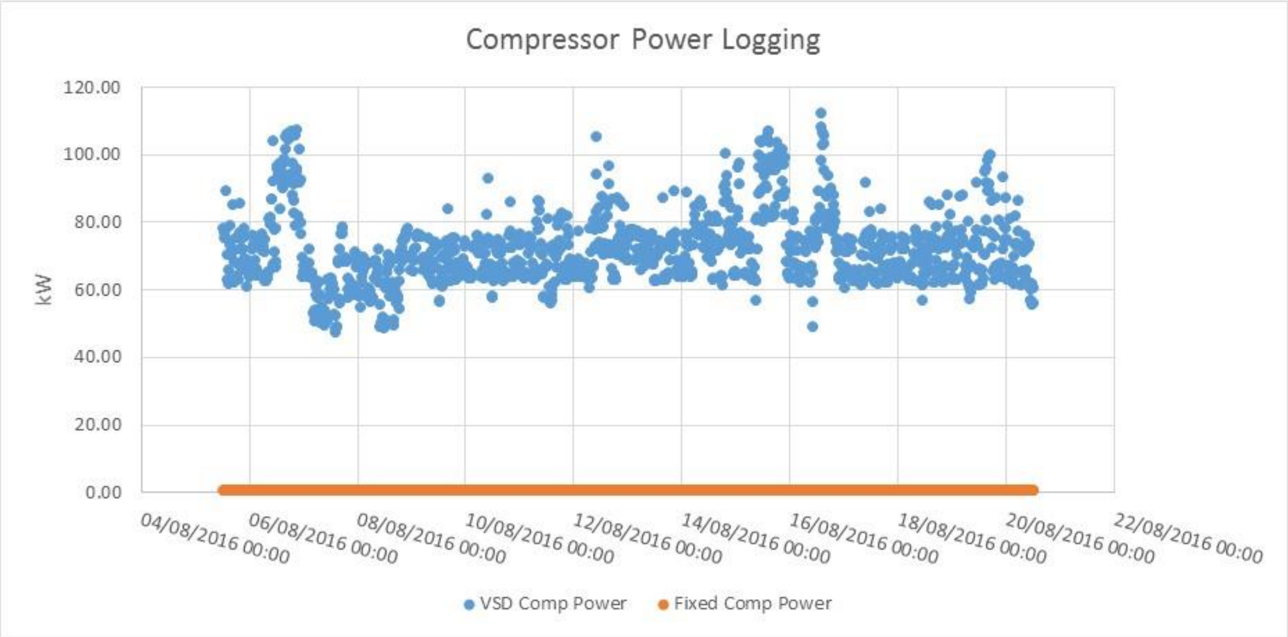
[5] SEAI, Energy Agreements Programme 2007 – Compressed Air Technical Guide

Specific shaft power (at stated pressure)			
psig	bar g	HP/100CFM	kW/m^3/min
145	10.0	25	6.5
140	9.5	24	6.3
135	9.2	24	6.2
130	8.8	23	6.1
125	8.5	23	5.9
120	8.2	22	5.8
115	7.8	22	5.8
110	7.5	21	5.7
105	7.1	21	5.6
100	6.8	21	5.5
65	4.4	17	4.5

The compressors control panel provides details of air volume flow rates and system pressure. A reading of 11.5 m^3/min at 9.8 bar was recorded during the audit. The compressor is rated to deliver 27.2 m3/min and so it was operating at 42% of its rated output at the time. According to the spec sheet data this corresponds to an electrical power consumption of 74.8 kW.

As part of the audit power logging of the VSD compressor and one of the fixed speed compressors was carried out over the course of 2 weeks. The average power consumption of the VSD compressor was recorded to be 71.4kW during this period and a graph of the results can be seen below. The fixed speed compressor that was monitored did not operate during this time period (as would be expected).

The power consumption recorded closely matches what the spec sheet power consumption was stating at given system pressures (assuming the flow rate witnessed on the VSD control panel during the audit was typical).



The data suggests that while the compressed air system load is generally steady, there are periods where they fluctuate.

The compressor auto stop pressure is 10.5 bar and the target pressure is 9.5bar. The control panel showed that it was delivering a pressure of 9.8 bar on the day of audit. The spec sheet suggests that 10 bar is the rated maximum pressure of the compressor. This pressure is reduced to 8 bar on the distribution network and the end users have a 6 bar requirement.

The system contains large receivers which are used to buffer demand peaks and ensure reliable operation of equipment. If these receivers, and system pipework are sized to deal with much larger flow rates than what is being witnessed, then this means that there should be scope for pressure reduction while maintaining reliable operation of equipment.

Savings

If the pressure setpoint could be safely reduced to 8.8 bar (2.8 bar above the requirement of the equipment) it would result in annual savings of 40,100 kWh, saving €3,400. Further reduction in pressures may be possible but any changes should be made incrementally. There is no capital expenditure required for this measure.

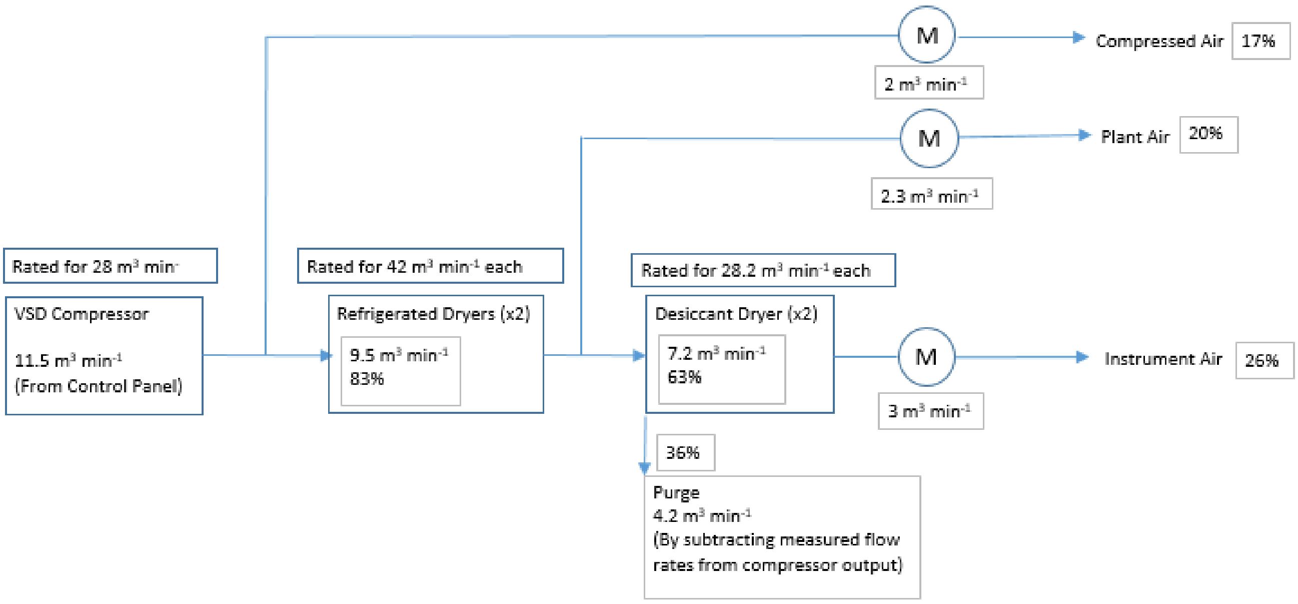
Specific energy use at 10 bar		6.5	kW/m3/min
Specific energy use at 8.8 bar		6.1	kW/m3/min
Volume flow rate		11.5	m3/min
Annual run hours		8,760	
Current annual energy use at 9.2 bar		654,810	
Annual energy use at 8.2 bar		614,514	
Saving kWh		40,296	
Saving €	€	3,425	

3.3.3. Compressed Air – Dryer Energy Use and Opportunities

Broadly speaking the compressed air system serves three separate circuits:

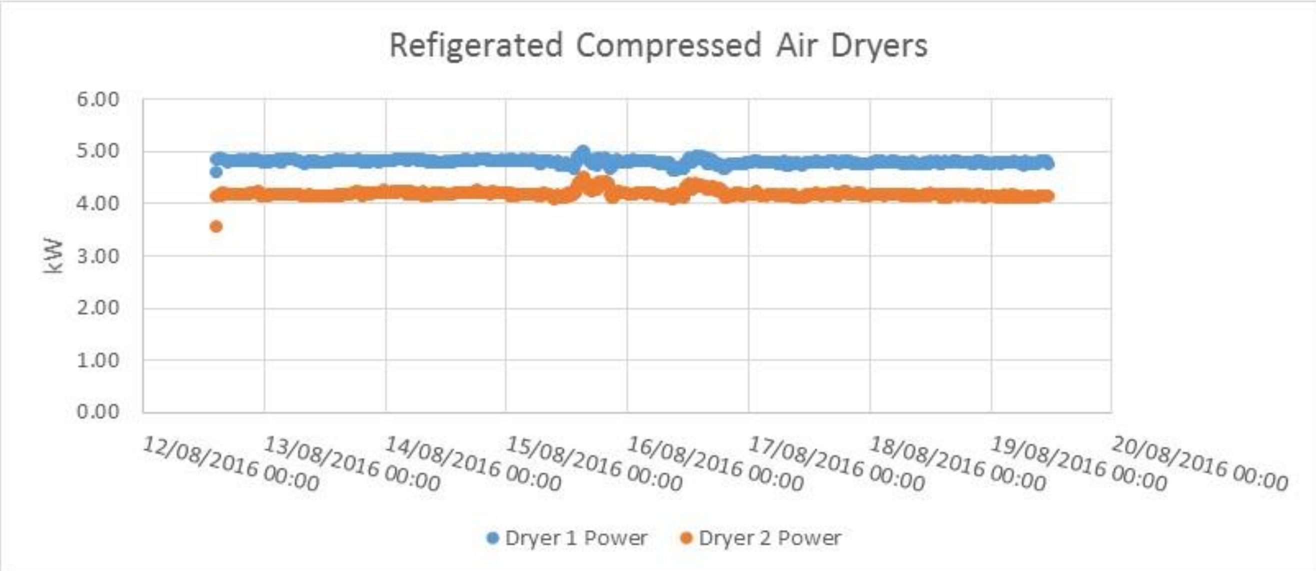
- **Compressed air** – Not dried
- **Plant air** – Dried using a refrigeration circuit to a dew point of 3 °C
- **Instrument air** – Once passed through the refrigerated drier, it is passed through a desiccant dryer to a dew point of -40 °C

The first step in this analysis was to establish the cost of refrigeration per m^3 of compressed air and map the air flows. There is air flow meters on the system which is logged on the DCS (Distributed Control System). The below simple schematic shows typical flow rates through the system as found on the day of audit. It also shows the % of total flow at each point and the equipment rated capacity.



Refrigerated Dryers

There are 2 dryers installed and both are running at the same time. The power consumption of both dryers was logged over the course of a week and the results are as follows



The results show that both dryers have a steady power consumption throughout the course of the week. There were small fluctuations on the 15th and 16th of August which corresponds to the fluctuations in the compressor power on those dates (see section 3.3.2).

An important observation is that the combined capacity of the dryers is 84 m^3/min, while on the day of the audit the requirement was 9.2 m^3/min meaning they are only 11% loaded. However, the combined average power consumption over the week of logging was 9 kW, while the combined nominal power consumption is 13.8 kW from the spec sheet. **So while they are doing 11% of their rated capacity they are using 65% of their rated power, indicating they have a very poor part load energy performance.** The spec for this dryer can be seen in Appendix B.

The measured specific power consumption of the dryer as it is currently configured is 1.7 kW/m^3/min. Their rated specific power consumption is 0.16 kW/m^3/min.

Savings

A simple measure which could be performed is to simply put one of the dryers into standby as a single dryer would be sufficient to deal with the load and its energy consumption would only increase a small amount. The measure could save up to 42,000 kWh of electricity. This would reduce the specific power consumption of the dryers by almost 50%. This requires no capital investment.

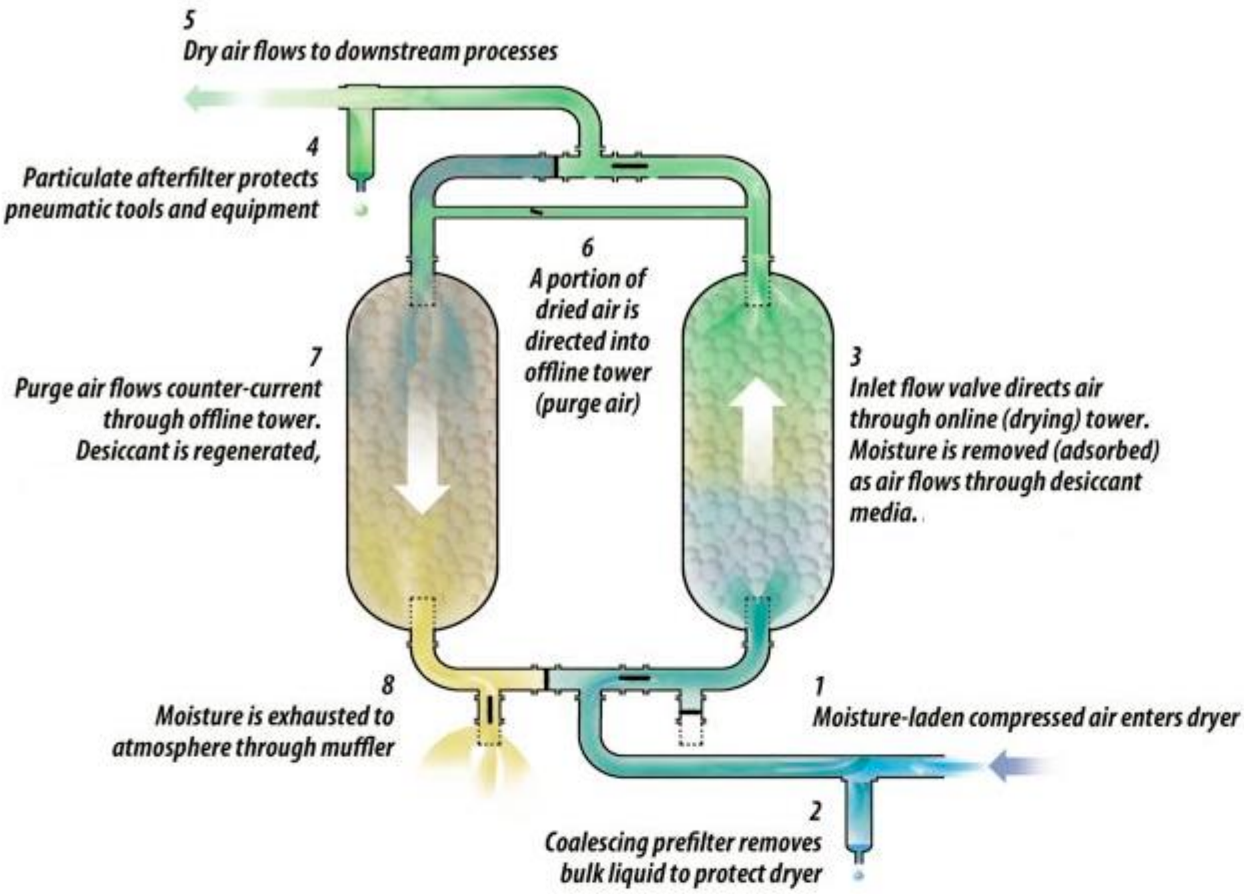
It should also be noted that Indaver are experiencing issues on their compressed air lines from water in the untreated air. This analysis seems to suggest that increasing the load on the refrigerated dryer by $2m^3$/min will not have a significant effect on energy consumption and so reconfiguration of the pipework to dry the compressed air line may be worth considering.

Desiccant Dryers

Desiccant dryers are used where the end compressed air user requires a high quality, dry air. There are many types of desiccant dryers, but the ones installed at Indaver are known as heatless dryers and are one of the more basic models available with low initial capital costs but higher operational costs. They are capable of delivering air with a dew point of -40 °C. Indaver have 2 dryers, but only operate one at a time.

Like all desiccant dryers, the units at Indaver have 2 towers filled with a desiccant material which absorbs moisture. Heatless dryers rely on dried air from the drying tower to purge the regenerating tower. This purged, wet air is then blown out to atmosphere. The below sketch describes the basic operating principles.

The spec of the existing desiccant dryer can be seen on Appendix C.

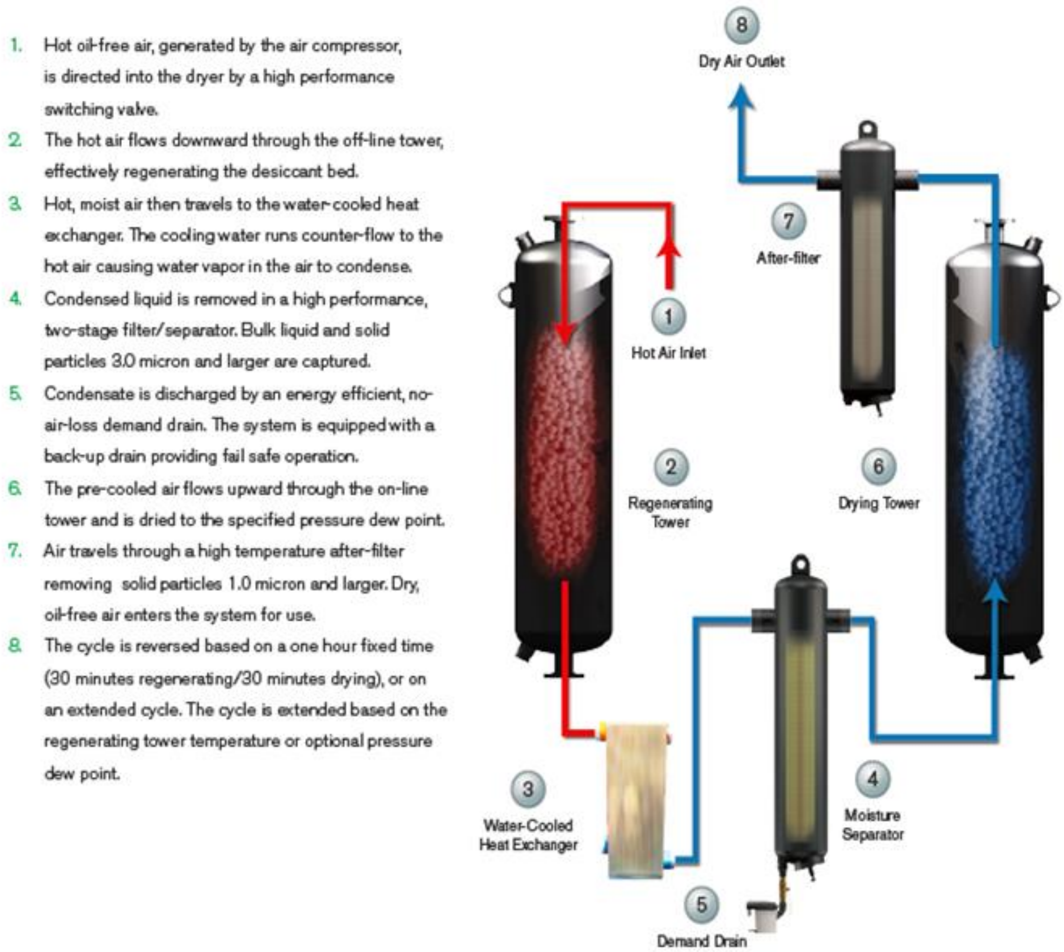


Each of the dryer's onsite have the capacity to dry 28.2 m3/min of compressed air. The spec sheet also notes that the nominal purge rate for the regenerating tower is 15% of total capacity, or 4.23 m3/min. However, the demand for instrument air at the time of audit was only $3m^3$/min which indicates the towers are significantly oversized. It also appears that by subtraction of the measured end user airflow requirements from the overall compressor output there is 4.2 m^3/min of air unaccounted for. This is the same as the nominal purge flow rate of the dryer and indicates that the purge function is a time based operation, not condition based. **This means that 36% of the compressors output from the compressor is used to purge the regenerating tower.**

The measured specific power consumption of the desiccant dryer as it is currently configured is 9.18 kW/m^3/min. Their rated specific power consumption is 0.98 kW/m^3/min at current system pressure.

Savings

As mentioned previously there are other models of desiccant dryer that are more efficient. The most efficient type of desiccant dryer is a 'Waste Heat Regenerative Dryer'. Its principle of operation as described from a Spirax Sarco brochure is as follows. It does not require any compressed air to be purged and instead uses a water cooled heat exchanger to remove moisture from the air.



This system would require some pipework reconfiguration so that the refrigerated dryer is bypassed allowing hot compressed air to be sent to the desiccant dryer and a water cooled heat exchanger would be required. However, the annual savings from this measure would be 232,600 kWh, or €19,700.

% of compressor power required (from spec)	5%	
Specific comp energy use at 10 bar	6.5	kW/m3/min
Annual energy requirement of proposed dryer	0.325	kW/m3/min
Measured average dryer demand	3	m3/min
Power required	0.975	kW
Annual energy use	8,541	
Origional annual dryer energy use	241,141	
Saving (kWh)	232,600	
Saving (€)	€ 19,771	

A less capital intensive alternative solution would be to replace the existing standby dryer with a more appropriately sized heatless dryer. This smaller unit could then be made the lead dryer. Ingersoll Rand supply a unit with a 3.4 m3/min capacity which would require a purge rate of 0.5 m3/min, an 88% saving. This would result in annual savings of 210,000 kWh, or €18,000.

It should also be noted that the desiccant material in these dryers must be changed periodically. This is a costly maintenance procedure and so presents an opportunity to replace the unit entirely with a smaller one at this time and offset the cost of this maintenance against this. Subsequent maintenance costs would also be reduced as the volume of desiccant in this unit would be lower, costing less to replace.

3.3.4. Compressed Air – Exhaust and Intake Air Cross Circuiting

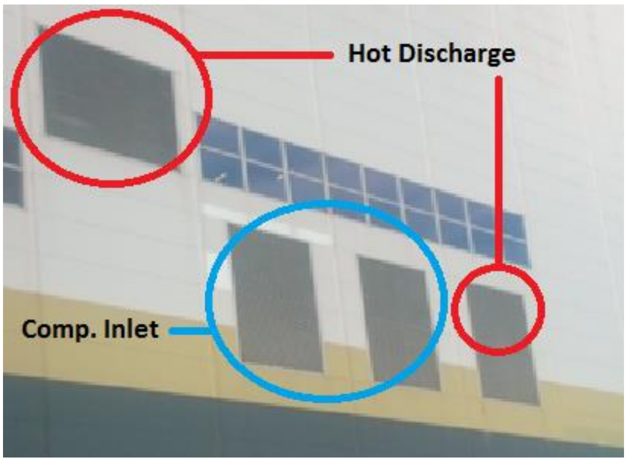
Compressors should be located in a well ventilated area, or capable of drawing inlet air from ambient conditions where possible. A 1% reduction in compressor power consumption can be achieved through a 4 °C reduction in inlet temperature[6].

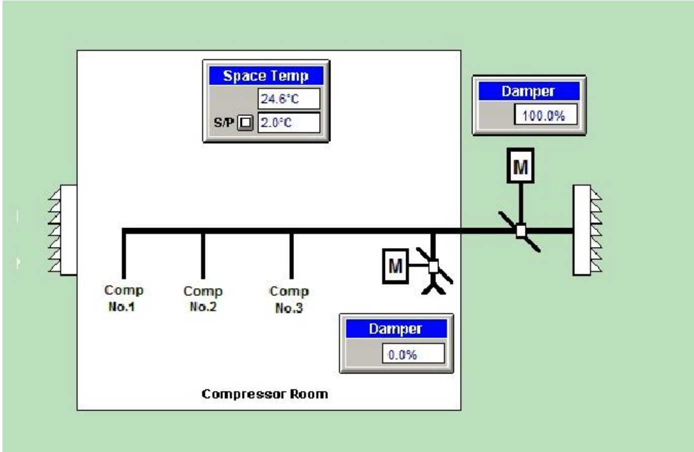
At the Indaver site the inlet temperature of the air being compressed at the day of audit was measured at 27.4 °C, on a day when ambient conditions were 18 °C. This is a difference of 9.4 °C and as a result the compressor was drawing 2.4% more power than required.

The cause of this short circuiting of hot air to the inlet of the compressor is from 3 sources:

1. The air which is used to cool the compressor is blown out of a grille which is very close to the compressor inlet grille on the exterior of the building. There is also another discharge grille from the turbine hall extract fan which is nearby. Hot discharge air is likely being drawn in the inlet grilles.
2. Inside the compressor plant room there is a motorised damper on a branch off the main extract duct. Its intent appears to be to let hot air into the plantroom to prevent against frost damage as the room has large grilles along one side and so is open to atmosphere. The below screenshot of the BMS shows a room setpoint of 2 °C and the damper position as being fully closed. The room temperature is shown as being 24.6 °C. However, on visual inspection of the damper from ground level it appears to be partially open allowing hot discharge air into the room.
3. Hot air from the lead VSD compressor is flowing out of the 2 fixed speed compressors which are off. They are all connected on the same ductwork header but there is no dampers in place to isolate them when they are off. This means hot air is escaping out of the inlets of the fixed speed compressors and short circuiting into the lead compressor inlet.

[6] SEAI Energy Agreements Programme 2007, Compressed Air Technical Guide





In order to prevent this short circuiting:

1. The damper which does not appear to be fully closing should be examined and the issue rectified.
2. Each compressor should have a motorised damper which would enable it to be isolated from the main header when offline.
3. Consider supplying the hot air up into the boiler hall rather than out through external cladding. This may have a knock on positive effect of raising the secondary air temperature which is taken from the top of the hall, improving combustion efficiency.

Savings

The potential savings from these actions is 15,400 kWh or €1,300. The budget cost to implement the recommendations are:

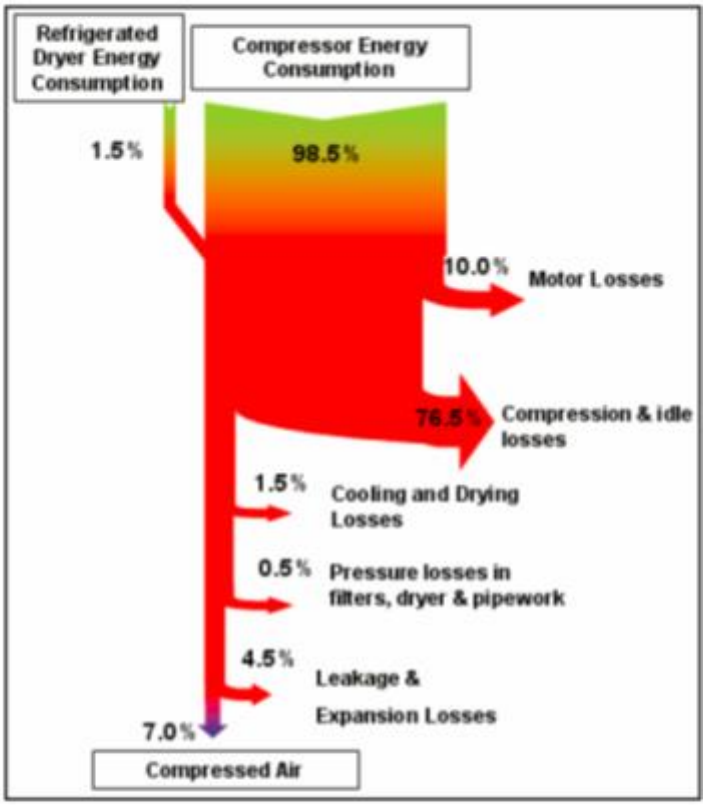
1. Repair the faulty damper - €1,000 (depending on issue identified)
2. Install motorised dampers and alter controls - €9,500
3. Re-route ductwork into the boiler hall - €7,000

A summary of the calculations can be seen as follows:

Inlet temp measured on day of test		27.4 °C
Ambient		18 °C
Difference		9.4 °C
% reduction in power usage		2.4%
Saving (kWh)		15,388
Saving (€)	€	1,308
Total cost to impliment changes (€)	€	17,500

3.3.5. Compressed Air – Heat Recovery

Up to 85% of the electrical energy supplied to a compressor can be recovered as heat. The below Sankey diagram illustrates the energy flow of a typical compressor system.



By installing a plate heat exchanger within the compressor and linking this to a hydraulic circuit this excess heat can be captured. The below image provides an indication of how this can be achieved.

This is only useful if an appropriate heat sink is available, at the appropriate temperature grade, to allow it to receive this heat. One such possibility in Indaver is to preheat the boiler make-up water which has been lost from blowdown and leaking drain valves. The volume of water used every day for this purpose is 26m^3 as advised by the client and this is supplied from the site well.

If the heat was recovered from the compressor and used to pre heat this water to 60°C before being supplied to the boiler feed tank, then the amount of energy required on a daily basis would be just under 1,450 kWh, with available heat from the compressor of 1,370 kWh

% of heat recoverable from compressor	80%
Average compressor power input (kW)	71.4
Daily heat available (kWh)	**1,370**
Daily makeup water volume (Litres)	26,000
Temp lift - 12 to 60 (^{o}C)	48
Energy required to raise water temp (kWh)	**1,449**
Note supply and demand are approximately equal	
Annual recoverable heat (kWh)	500,078

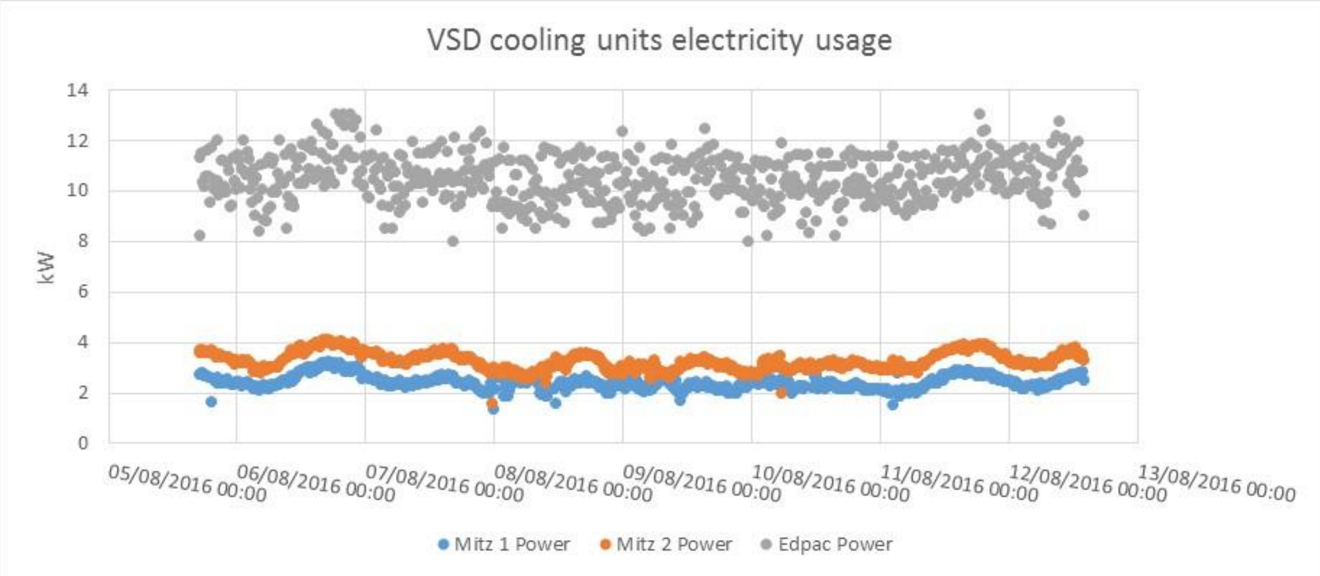
If this heat was recovered to the system the potential additional electricity that could be generated for the same MSW input would be 158,000 kWh, with a value of €13,400.

3.3.6. VSD MCC Room Free Cooling

The VSD MCC room is currently cooled by:

- 1no. Edpac Upflow unit with twin 50kW (100kW of total cooling capacity) circuits with fixed compressor speed.
- 2no. Mitsubishi ducted ceiling units, each with 25kW capacity (cooling), inverter driven. Added after the facility was constructed.

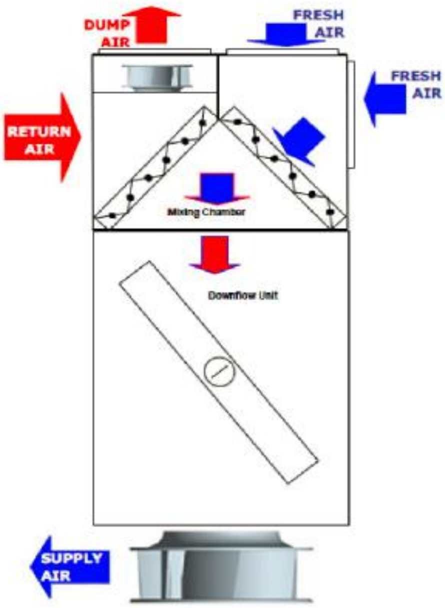
The power consumption of these units was logged over the course of a week at 15 minute intervals. The results are as follows:



Based on a notional COP of 3 for the Edpac, and 3.5 for the Mitsubishi units, the total cooling load for the room is approximately 42kW. These COPs are estimates and were used to get an order of magnitude cooling load to see if the cooling units were appropriately sized. This does indicate that the Edpac unit should have enough capacity to cool the room on its own with full redundancy as was the original design intent, but the distribution of airflow is not ideal which restricts its effectiveness and this will be discussed later.

The graph shows that the load is relatively stable and it also demonstrates the difference between an inverter driven compressor and a fixed speed unit. The Mitsubishi units have a much smoother power consumption profile, while the Edpac has a ‘choppy’ profile as a result of compressors kicking in and out.

One way of reducing the cooling power consumption in the room is to use ambient air to ‘free cool’ in times where the ambient air temperatures are below 16 °C. Ambient air could be drawn in through an opening in the back wall of the room, behind where the existing Edpac unit is. The hot return air could be blown up through the above slab, into the boiler hall. The below sketch shows a typical configuration.



Due to the moderate climate in Ireland, free cooling is possible for a high % of the year. Based on 2014 weather data, the number of hours the weather was below 16 °C was 7,030 hours, or 80% of the time. The potential electrical savings from installing a free cooling unit, and using the Mitsubishi units as standby units only, would be approximately 113,000 kWh, or €9,600.

The budget cost to supply and install 2no. 50kW free cooling Edpac units is €60,000. These units can also incorporate humidly control if required.

The configuration shown is a downflow unit, with cold air being supplied at low level. This is better than supplying cold air at high level and drawing in hot air at low level as is currently the case. The racks and panels are designed to draw in air at low level with their own fan and dump hot air to high level. By supplying cold air at low level this helps deliver the cold air to where it is required. The hot air at the top of the units should be ducted back to the Edpac to prevent short circuiting of cold supply to hot return. This will improve the performance of the cooling system and improve the distribution of airflow.

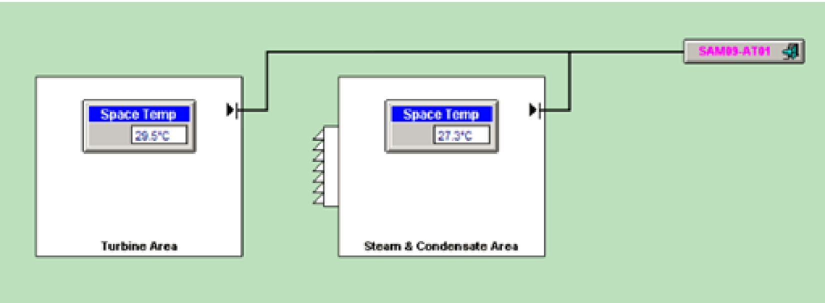
It is also recommended that the return air be ducted from the VSDs back to the Edpac unit, provide proper hot aisle / cold aisle separation. This is best practice and will ensure the Edpac units can operate at the highest acceptable temperature, thereby minimising energy use.

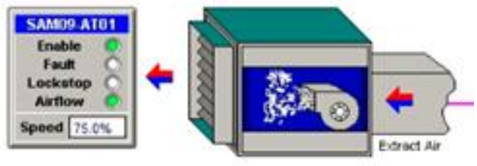
Mechanical dampers will have to be installed on any new openings to the room due to the presence of an Inergen gas suppression system. When an alarm is activated the dampers would have to close to prevent the escape of this gas.

3.3.7. Turbine Hall Extract Fan Control

The Turbine Hall and the Steam & Condensate Area are cooled by a large fan which draws out hot air through ductwork at high level and passively pulls air in from outside through openings in the building fabric.

This fan is connected to the BMS and the room temperatures are monitored but the fan does not appear to be controlled, and is running at a constant speed of 50 Hz, drawing 18 kW of power according to its VSD. The fan is at full speed, although he BMS is providing a 75% signal – this requires some investigation to determine why this is.





The room temperatures at the time of audit as can be seen in the above screenshots was 29.5 and 27.3 °C respectively. The ambient air temperature was approximately 18 °C.

If the strategy was changed to control the fan speed to a room setpoint of, for instance, 35 °C, then the fan speed could reduce. The BMS would control the fan speed to maintain the temperature in whichever the hotter room is. The power savings would be highest in the winter where the ambient air temperatures are lower, providing more cooling capability.

To establish indicative from reducing the fan speed site testing was conducted. The fan speed was manually controlled on the VSD for a short period and power readings were taken from the VSD.

- @ 50Hz power consumption was 18 kW
- @ 45Hz power consumption was 13.2 kW – Annual savings of 42,050 kWh possible
- @ 40 Hz power consumption was 9.3 kW – Annual savings of 76,200 kWh possible

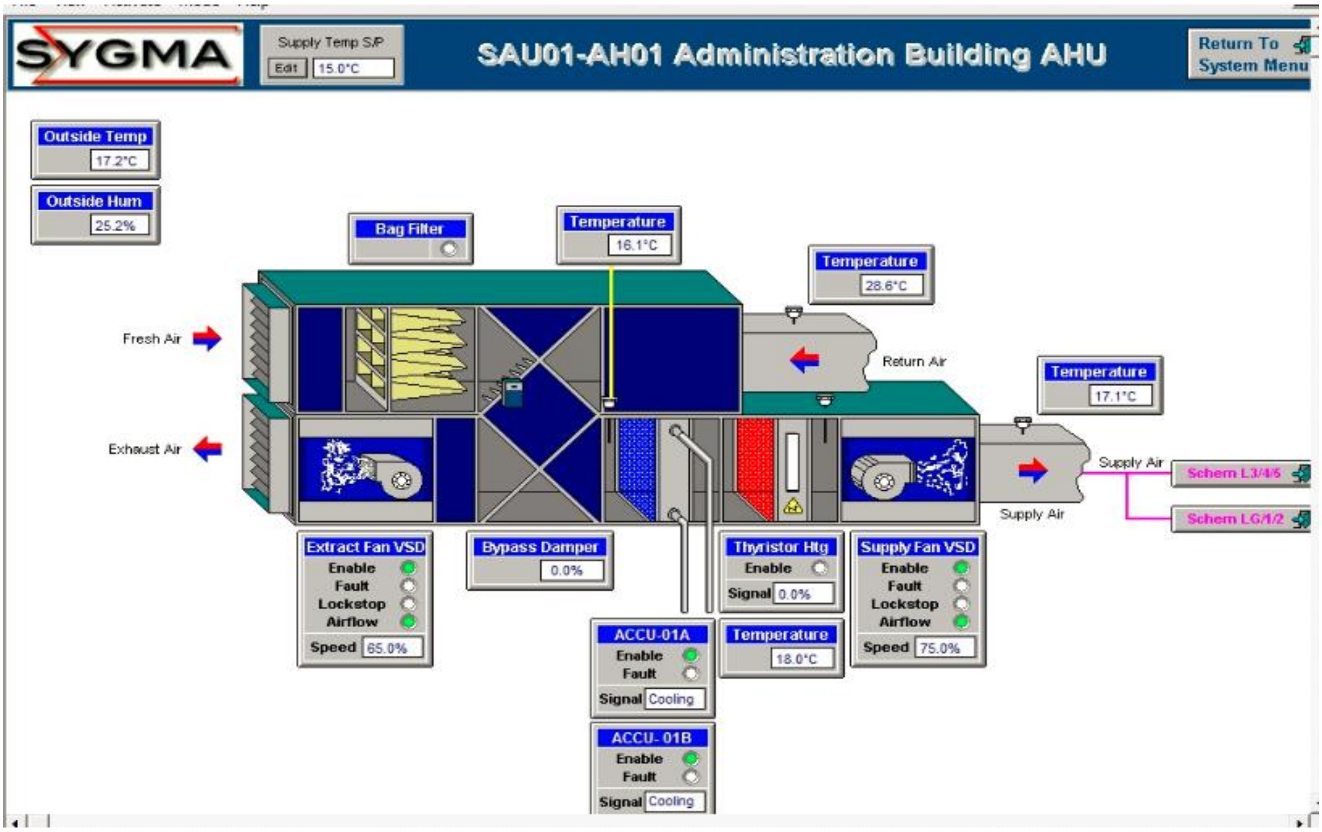
The potential annual energy savings have also been calculated above based on maintaining different average fan speeds. The capital costs will be small as it just requires some strategy changes and could be done as part of routine maintenance.

3.3.8. Admin Building AHU Control

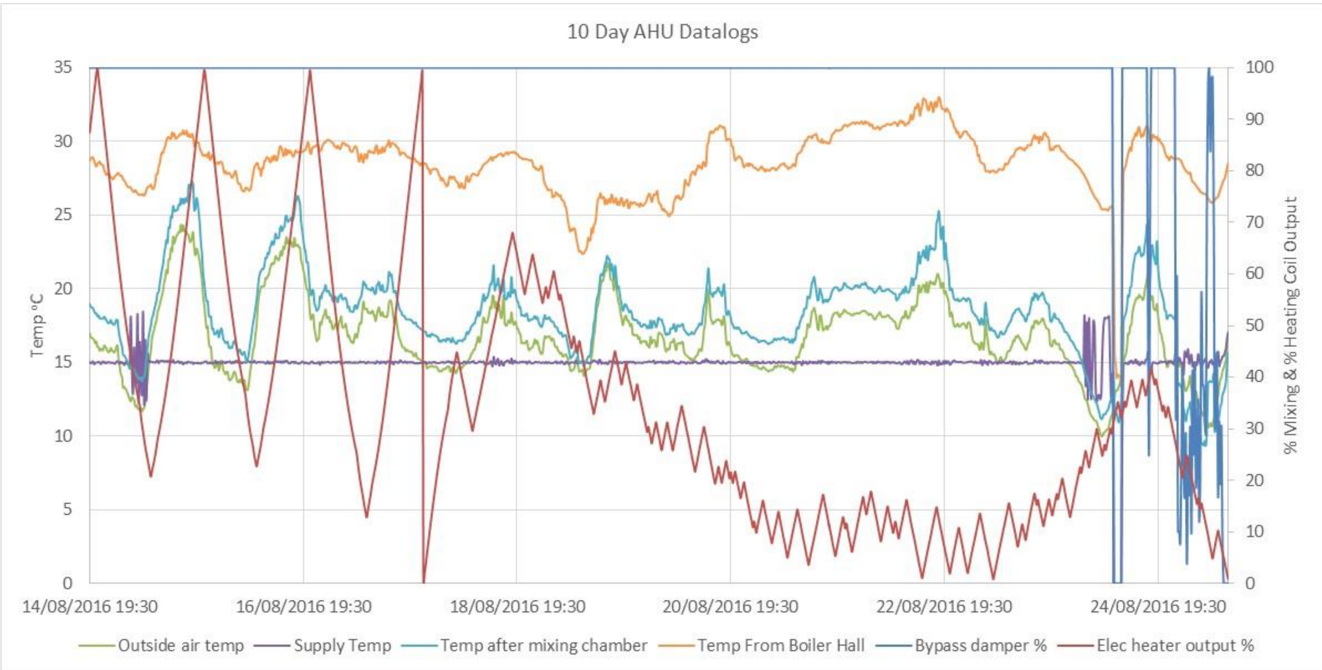
The Admin building is supplied with tempered fresh air on a continual basis from an AHU with a 66 kW electrical heating coil, a DX cooling coil and a heat recovery section which recovers heat by extracting hot air from the top of the boiler and passing it over a cross flow heat exchanger, fitted with a bypass. The unit is controlled on the BMS and is currently set to supply air at 15 °C, with local duct electrical reheats where required. The fans are VSD driven but are currently controlled to fixed setpoints as follows:

- Supply fan @ 75% speed, drawing 3.9 kW
- Return fan (from boiler hall) @ 65%, drawing 1.8 kW

The building also has ceiling cassette split units for cooling and heating. A separate extract system dumps stale air at roof level. The building must be positively pressurised to prevent the ingress of smells from the waste which is stored onsite and so the supply and extract systems are balanced.

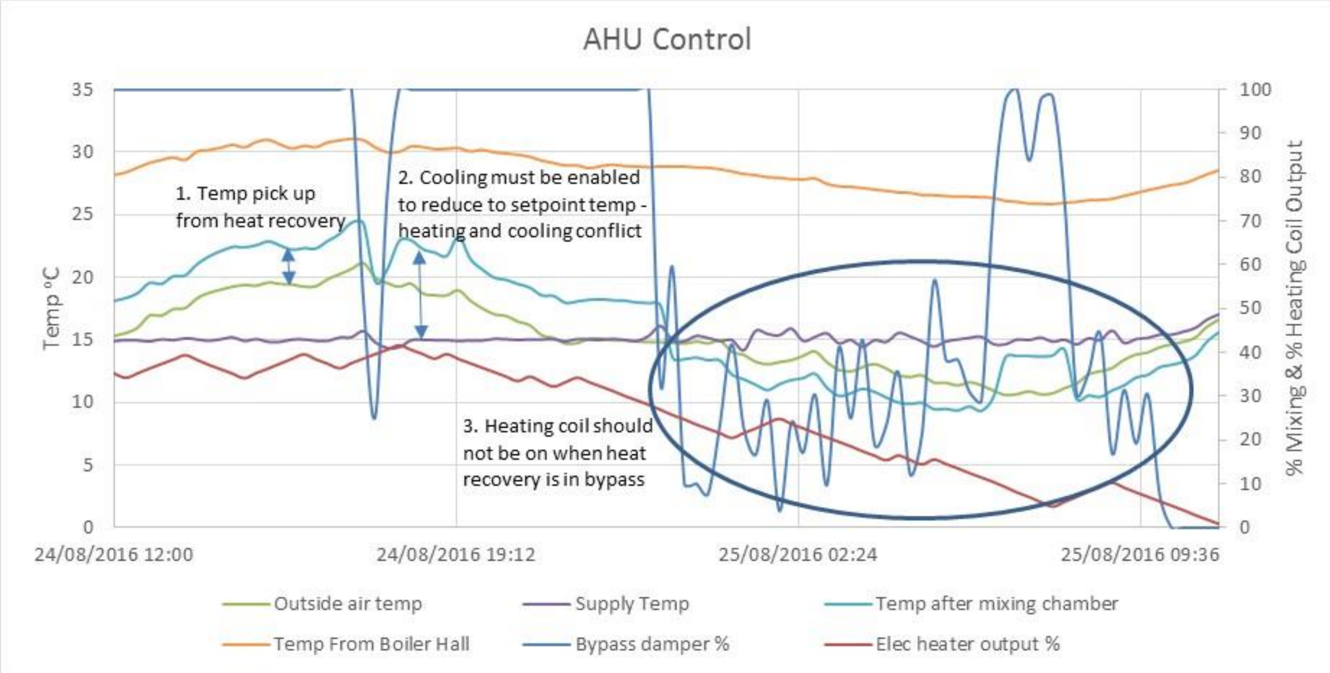


During the audit a number of datalogs which were available on the BMS were downloaded and subsequently plotted against each other to examine how the AHU was controlling. The default amount of data stored on the BMS is 10 days.



From the above graph it can be seen that the supply temperature is in general controlled to very tight limits as can be seen by the flat line. Where there are deviations in this temperature (such as on the 15th of August) the heating coil output tends to react very slowly, but over a wide range. This suggests that the control response time needs to be altered.

It is beneficial to look at a shorter time period where it is easier to look at the detail of what is occurring. The below chart looks at the 24th and 25th of August, when the bypass damper is modulating.



Some points to note are as follows:

1. When the system is in full heat recovery mode (bypass damper is at 100%) the temperature pick up is approximately 2 ˚C. Considering the temperature of the air coming from the boiler hall was 10 ˚C higher than the ambient one would expect a greater temperature uplift.
2. The ambient temperature was above the 15 ˚C setpoint at the time, however the AHU was still recovering heat, and the heating coil output was 40%. Unfortunately there was no facility to download the datalog for cooling demand, but one can only deduce that the cooling coil must also have been on to bring the temperature down to its setpoint. This shows a conflict between the cooling coil, heat recovery and heating coil.
3. When the ambient air temperature goes below the setpoint the first thing that should have reacted was the heating coil, not the heat recovery damper. The priority should be to recover heat first and then to use the heating coil.

The above indicates significant energy wastage is occurring due to poor control.

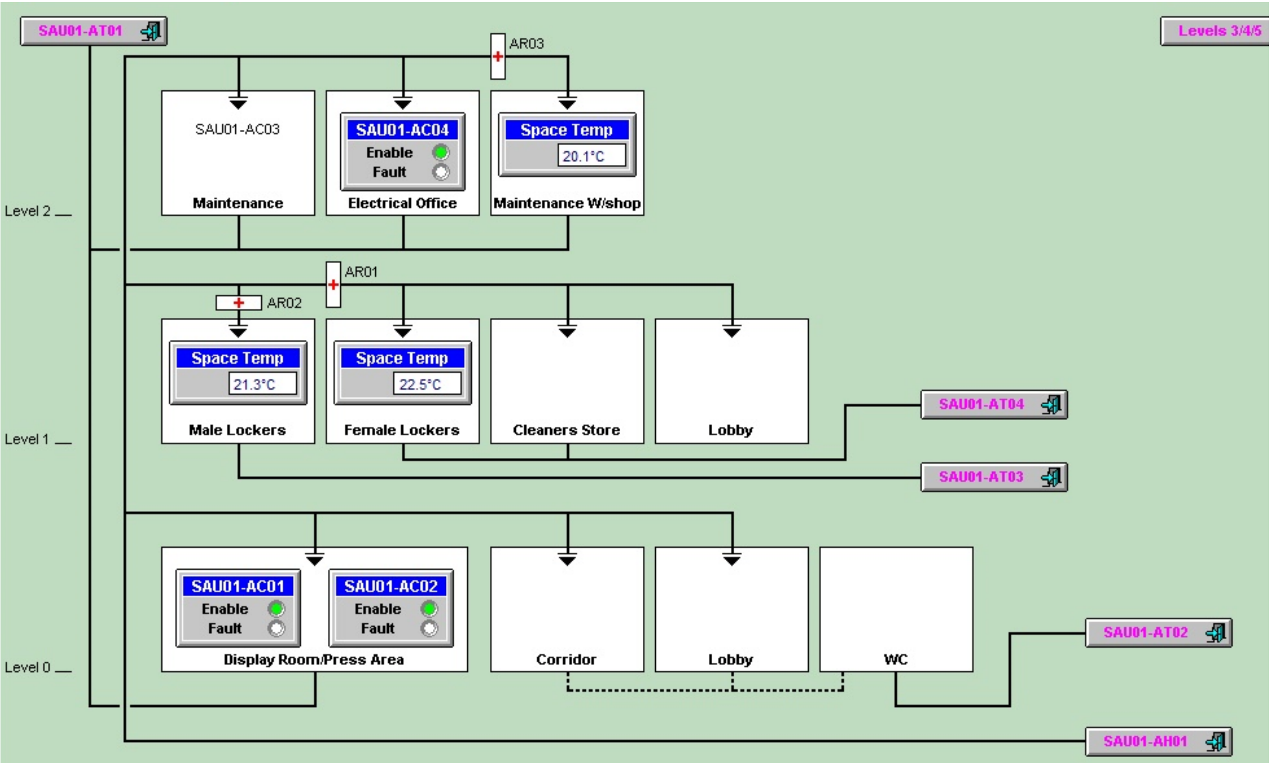
Recommendations and Savings

1. Turn off the AHU and extract fans outside of normal office hours and install a dedicated heat recovery ventilation system in the control room as this is the only area requiring ventilation at night. Openings in the walls could be made at the control room level to allow for local supply and extract of air. This will save on AHU fan and heating coil power.

Item	Power Consumption kW	Annual Energy Use	Proposed Run Hours	Savings kWh	Savings €
Supply Fan	3.9	34,164	5,110	14,235	€ 1,210
Return Fan	1.8	15,768	5,110	6,570	€ 558
Other 5no. Extract fans	1.5	13,140	5,110	5,475	€ 465
Heating Coil savings		84259	5,110	40,774	€ 3,466
			Total	**67,054**	**€ 5,700**

Note: The heating coil savings figure assumes the AHU is performing as expected. This results in a conservative savings figure. There will also be a small added electrical load from the installed heat recovery unit but its impact would be negligible. The cost to make the strategy changes and install a heat recovery unit would be approximately €15,000.

2. The AHU heating coil output control response time should be faster. This is primarily a measure which will improve performance but some energy savings may also be achieved by ramping back the heating coil faster to avoid having it on as well as bypassing the heat recovery section.
3. When there is heat available for recovery this should take priority over the heating coil. The control strategy does not seem to be set up like this as one would expect. As the system is performing outside of the normal parameters, accurate calculation of savings is not possible.
4. There should be a dead band of 2 °C put in place, i.e. 1 °C either side of the setpoint. The heating coil should only be enabled when below this dead band and the cooling coil only enabled when above it. This should prevent simultaneous heating and cooling. This may result in slight fluctuations in supply temperatures but this is not a critical temperature and so should be acceptable. This will result in savings but as the information on the performance of the AHU is limited to the 10 day log that was captured during the audit the calculation of effect of making this change over the course of the year is difficult. The cost to implement this change in strategy is small.
5. The supply setpoint should be dynamic rather than fixed to reduce the amount of electrical reheating. The areas of the building with reheat control have space temperatures logging on the BMS. If an area is starting to overheat, and its reheat is off, then the AHU supply temperature should reduce. There should never be a requirement for all reheats to be on at the same time. This will save energy as the AHU recovers heat from the boiler hall.



Without detailed design data and logging of reheat energy demand over a period of time it is difficult to calculate savings accurately. As this is a change in strategy the cost to implement is small.

6. The AHU return fan should be ramped up to increase the fan speed when heat recovery is required and ramp the speed down when the ambient temperature approaches the setpoint, shutting it down

when the ambient is higher. This would effectively mean the bypass damper should always be at 100%, and the fan speed would ramp rather than modulating the damper. It should be possible to recover more than 2 °C from the return fan given its relatively high temperature of approximately 30 °C. If the flow rates between the supply and the return were equal, and the heat exchanger was 90% efficient then there should be no need for electrical heating until the ambient conditions are below approximately 5 °C.

By changing the control strategy to switch off the return fan when the ambient is above 15°C the savings were calculated to be 4,266 kWh, or €363. The savings from increasing the amount of heat being recovered from the boiler could be significant. The estimated total annual consumption of the heating coil is 84,259 kWh. The cost to implement the control strategy change is small and the savings could be 30 – 60%.

3.3.9. LED Lighting and Controls Upgrade

When the facility was built LED fittings were not installed. In recent years LEDs have decreased in price and the quality has improved. There is a significant lighting load onsite and there is potential for controls improvements also.

The existing lighting within the facility is made up of twin, 5ft fluorescent fittings which are left on 24x7. As the building has a lot of clear roof and cladding sections there is a good deal of ambient light available. Depending on how the lighting circuits are configured, it may be possible to only leave the lights above access ways on, and operate the remaining lighting on a photocell.

Outside the building there are 400W son fittings installed which are operated on a photocell.

The client has provided an estimated number of fittings and these have been used to calculate savings figures as per the below table.

	Pre Retrofit						
Area	Pre Retrofit fittings	No. fittings	Watts per fitting	Load kW	Control	Hrs per year	Electricity per year, kWh
Outside Lighting	400W SON	40	420	16.80	Photocell	4,150	69,720
Inside Lighting - Main Access Routes	Twin 5ft T8 flourescent	150	133.4	20.01	Switch	8,760	175,288
Inside Lighting - All Other Areas	Twin 5ft T8 flourescent	350	133.4	46.69	Switch	8,760	409,004
Grand Total							654,012

	Post Retrofit							Savings	
Area	Post Retrofit fittings	No. fittings	Watts per fitting	Full Load kW	Control	Hrs p.a. at Full Load	Electricity per year, kWh	kWh saving p.a. incl. controls	Comments
Outside Lighting	200 W LED	40	200	8.0	Photocell	4,150	33,200	36,520	Default control gear loss 5% per seai EEOS guidance
Inside Lighting - Main Access Routes	60 W LED	150	60	9.0	Switch	8,760	78,840	96,448	Default control gear loss 15% per seai EEOS guidance
Inside Lighting - All Other Areas	60 W LED	350	60	21.0	Photocell	4,150	87,150	321,854	Default control gear loss 15% per seai EEOS guidance.
Grand Total							199,190	454,822	

The estimated costs and paybacks to implement this upgrade are as follows:

Area	Post Retrofit fittings	No. fittings	Cost Per fitting	Control	Cost	Energy cost savings	Payback
Outside Lighting	200 W LED	40	€ 350	Photocell	€ 14,000	€ 3,104	4.51
Inside Lighting - Main Access Routes	60 W LED	150	€ 90	Switch	€ 13,500	€ 8,198	1.65
Inside Lighting - All Other Areas	60 W LED	350	€ 90	Photocell	€ 31,500	€ 27,358	1.15
				Totals	**€ 59,000**	**€ 38,660**	**1.53**

Note: The implementation cost does not include labour and it is assumed this could be carried out under maintenance over an extended period.

Appendix A – Well Water Control Energy Saving Testing Methodology

It was noted that the pumps appear to be pumping against the ball cock which is reducing the flow as the pressure at the top of the well according to a gauge was at 6.5 bar, and it cuts out at 8bar. The pump is drawing 7.2kW at a fixed 60% speed and delivering 7 m3/hr. The pump is working to overcome the back pressure on the ball cock and it would be more efficient to control the pump speed to a level based on a sensor, with the ball cock acting as a last resort. To test what the elec savings would be the following test should be conducted.

1. Take note of the flow rate, head pressure (on a gauge at the top of the well), ball cock position (partially closed or fully open), pump speed (%) and power consumption (kW).
2. Ramp back the well pump and allow the tank level to drop below the point where the ball cock is fully open (assuming it is partially closed to begin with).
3. Continually monitor the tank level (to make sure there is no risk to the process) and flow rate in the pipe.
4. Once the level of the water has dropped sufficiently ramp the pump speed up until a flow rate similar to that of before the test is achieved, ensuring the ball cock is fully open. Also check that this figure is typical for a standard day of operation by looking back at the logs.
5. Once the correct flow rate is achieved, and at least 10 minutes has passed, note the pump speed (%), pressure at the head of the well (bar - there is manual gauge there) and the power consumption (kW – this can done by scrolling through the parameters menu).

The pump should be drawing less power than when it was pushing against the ball cock. The pressure at the head of the well should also be lower. The level of saving will influence the decision on whether to implement the new control measure or not.

Appendix B – Refrigerated Dryer Spec Sheet

Ingersoll Rand

TECHNICAL DATA SHEET

Tag numbers: QEA03 AT010 & AT020

ST 08A.2700AG0.00B0

Rev. 00 Pg. 1/1

Date 26.06.08

REFRIGERATED COMPRESSED AIR DRYER

ESSICCATORE D'ARIA COMPRESSA A REFRIGERAZIONE

MODEL:	MODELLO:		**D2520IN-A 400/3/50**	
RATED CAPACITY	*PORTATA :*	m3/h l/min cfm	2520 42000 1482	
Power supply	Alimentazione	V/Ph/Hz	400/3/50	
Power consumption	Consumo nom.	KW	6,88	
Full Load cons.	Consumo max.	KW	8,7	
Rated absorpt.	Ass. nominale	Ampere	11,6	
Full Load Ampere	Ass. pieno carico	Ampere	14,3	
Lock. Rotor Ampere	Ass. spunto	Ampere	80	
Weight	Peso	Kg	330	
Air connection	Attacchi aria	FLG	DN 100	
Coolant type	Tipo refrigerante	Freon	**R 507**	
Inlet air temp.	Temp. aria ingr.	°C / °F	35 /95	(Max 60 / 140)
Outlet air temp.	Temp. aria uscita	°C / °F	25 / 77	(Max 40 / 104)
Ambient temp.	Temp. Ambiente	°C / °F	25 / 77	(Max 45 / 113)
Working pressure	Press. Nominale	bar	7 / 100	(Max 12 / 174)
Pressure drop	Perdita carico	bar / psi	0,28 / 4,06	(Max 0,35 / 5)
Pressure dew point	P.to rugiada	°C / °F	3°/37°	ISO CLASS 4

Appendix C – Desiccant Dryer Spec. Sheet

Ingersoll Rand

TECHNICAL DATA SHEET

Tag numbers: QEA05 AT010 & AT020

ST 08U.1600BG.0
Rev. 00 Pag. 1/1
Date 9/22/2009

DESICCANT DRYER

MODEL		**D1600IL-40C**	
TYPE		**HEAT-LESS REGENERATION**	
OPERATING DATA			
APPLICATION FLUID		AIR	
NOMINAL CAPACITY	l/min	28500	
	m³/h	1694	
	cfm	1000	
PRESSURE RATE	bar	7	
INLET AIR TEMPERATURE RATE	°C	35	
PRESSURE DEW POINT	°C	- 40	
RELATIVE HUMIDITY INLET AIR	%	100	
PRESSURE DROP	bar	0.2	
DRYING CYCLE COMPLETE	min	10	
DRYING TIME FOR ONE COLUMN	min	5	
REGENATION AIR CONSUMPTION (NOMINAL FLOW RATE)	%	15	
OPERATING LIMITS			
MAXIMUM WORKING PRESSURE	bar	10	
MAXIMUM WORKING TEMPERATURE	°C	50	
MAXIMUM AMBIENT TEMPERATURE	°C	50	
GENERAL DATA			
AIR CONNECTION	IN/OUT	3" BSP	ISO 7/1
POWER SUPPLY	V/Ph/Hz	230/1/50	
DESSICANT MEDIUM		Alumina	
ELECTRICAL PROTECTION		IP 54	
WEIGHT	kg	1015	
HEIGHT (A)	mm	2230	
LENGTH (B)	mm	1630	
WIDTH (C)	mm	1310	