INDAVER WASTE TO ENERGY FACILITY RINGASKIDDY– ASSESSMENT OF COMPLIANCE WITH REFERENCE DOCUMENT (REF) ON BEST AVAILABLE TECHNIQUES FOR ENERGY EFFICIENCY, FEBRUARY 2009

SCOPE
The BREF is a horizontal document as is not industry specific. Applies to all IE Licenced Facilitates.

The full and complete REF is available at the EIPPC Bureau website: http://eippcb.jrc.ec.europa.eu/reference/

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
4.2.1 Energy Efficiency Management		
BAT 1. BAT is to implement and adhere to an energy efficiency management system (ENEMS) that incorporates, as appropriate to the local circumstances, all of the following features (see Section 2.1). a. Commitment of top management (commitment of the top management is regarded as a precondition for the successful application of energy efficiency management). b. Definition of an energy efficiency policy for the installation by top management. c. Planning and establishing objectives and targets (see BAT 2, 3 and 8). d. Implementation and operation of procedures paying particular attention to: • Structure and responsibility • Training, awareness, and competence (see BAT 13) • Communication • Employee Involvement • Documentation • Effective control of processes (see BAT 14) • Maintenance (see BAT 15) • Emergency preparedness and response	Applicable - The facility will be operated in accordance with an Environmental Management System (EMS) which will be updated annually in accordance with the IE licence requirements. This sets out annual targets including targets for energy efficiency. The process is controlled by an interface computer system which allows for fine tuning of the process and the monitoring of all process parameters in order to optimise efficiency. Section 9 of this licence application provides a summary of the many energy efficiency measures incorporated into the design of the facility.	Proposed facility – BAT to be in place prior to commencement.

• Safeguarding compliance with energy efficiency-related legislation and agreements (where such agreements exist). e. Benchmarking: the identification and assessment of energy efficiency indicators over time (see BAT 8), and the systematic and regular comparisons with sector, national or regional benchmarks for energy efficiency, where verified data are available (see Sections 2.1(e), 2.16 and BAT 9). f. Checking performance and taking corrective action paying particular attention to: • Monitoring and measurement (see BAT 16) • Corrective and preventive action • Maintenance of records • Independent (where practical) internal auditing in order to determine whether or not the energy efficiency management system conforms to planned arrangements and has been properly implemented and maintained (see BAT 4 and 5) g. Review of the ENEMS and its continuing suitability, adequacy, and effectiveness by top management.		
4.2.2 Planning and establishing objectives and targets		
4.2.2.1 Continuous environmental improvement		
BAT 2. BAT is to continuously minimise the environmental impact of an installation by planning actions and investments on an integrated basis and for the short, medium, and long term, considering the cost-benefits and cross-media effects.	Applicable - Continual improvement will be achieved through the implementation of the EMS and the setting of annual targets and objectives, in particular improved energy efficiency and reduced potential environmental impact.	Proposed facility – BAT to be in place prior to commencement.
4.2.2.2 Identification of energy efficiency aspects of an installation and opportunities for energy savings		
BAT 3. BAT is to identify the aspects of an installation that influence energy efficiency by carrying out an audit. It is important that an audit is coherent with a systems approach (see BAT 7).	Applicable - Energy audits will be carried out in accordance with relevant EPA guidance to identify further opportunities for energy efficiency improvement as part of facility management systems. The results of these audits will be reported	Proposed facility – BAT to be in place prior to commencement.

	annually in the facility's AER. SI 426 of 2014 will be followed.	
BAT 4. When carrying out an audit, BAT is to ensure that the audit identifies the following aspects (see Section 2.11): a. Energy use and type in the installation and its component systems and processes b. Energy-using equipment, and the type and quantity of energy used in the installation c. Possibilities to minimise energy use, such as: • controlling/reducing operating times, e.g. switching off when not in use (e.g. see Sections 3.6, 3.7, 3.8, 3.9, 3.11) • ensuring insulation is optimised, e.g. see Sections 3.1.7, 3.2.11 and 3.11.3.7 • optimising utilities, associated systems, processes, and equipment (see Chapter 3) d. Possibilities to use alternative sources or use of energy that is more efficient, in particular energy surplus from other processes and/or systems, see Section 3.3 e. Possibilities to apply energy surplus to other processes and/or systems, see Section 3.3 f. Possibilities to upgrade heat quality (see Section 3.3.2)	Applicable - Energy audits will be carried out in accordance with relevant EPA guidance to identify further opportunities for energy efficiency improvement as part of facility management systems. The results of these audits will be reported annually in the facility's AER. SI 426 of 2014 will be followed.	Proposed facility – BAT to be in place prior to commencement.
BAT 5. BAT is to use appropriate tools or methodologies to assist with identifying and quantifying energy optimisation, such as: • Energy models, databases, and balances (see Section 2.15) • A technique such as pinch methodology (see Section 2.12) exergy or enthalpy analysis (see Section 2.13), or thermoeconomics (see Section 2.14) • Estimates and calculations (see Sections 1.5 and 2.10.2)	Applicable – An energy database will be developed to assist in identifying opportunities for energy optimisation. Energy balances will be calculated from data collected as part of the energy database. This will form part of the EMS for the facility with balances reviewed at least annually. At the micro-level, specific unit operations such as heating, cooling, or lighting systems will be subject to energy	Proposed facility – BAT to be in place prior to commencement.

	efficiency assessment as part of design stage and procurement.	
BAT 6. BAT is to identify opportunities to optimise energy recovery within the installation, between systems within the installation (see BAT 7) and/or with a third party (or parties), such as those described in Sections 3.2, 3.3 and 3.4.	Applicable – Specific unit operations such as heating, cooling, or lighting systems are subject to energy efficiency assessment as part of design stage and procurement.	Proposed facility – BAT to be in place prior to commencement.
4.2.2.3 A systems approach to energy management		

BAT 7.
BAT is to optimise energy efficiency by taking a systems approach to energy management in the installation. Systems to be considered for optimising as a whole are, for example:
• Process units (see sector BREFs)
• Heating systems such as:
  o steam (see Section 3.2)
  o hot water
• Cooling and vacuum (see the ICS BREF)
• Motor driven systems such as:
  o compressed air (see Section 3.7)
  o pumping (see Section 3.8)
• Lighting (see Section 3.10)
• Drying, separation and concentration (see Section 3.11)
	Applicable – At design stage, each unit operation has been assessed for energy efficiency most notably process, heating, cooling, HVAC, motors/transformers, and lighting.
	
	Operational control – the automation control system only turns on equipment as needed to optimise energy use. Where practical, equipment will be kept on standby until required.
	
	Variable speed drives will be used where practical for conveyors, compressors, pumps.
	
	Selection of furnace technology has been made on the basis of efficient design. Waste heat generated from incineration will be re-used in the Waste Heat Boiler for electricity generation.
		Proposed facility – BAT to be in place prior to commencement.

	High efficiency lighting used (LED lights used. PIR or 'smart lighting' in place where possible).	
4.2.2.4 Establishing and reviewing energy efficiency objectives and indicators		
BAT 8. BAT is to establish energy efficiency indicators by carrying out all of the following: a. Identifying suitable energy efficiency indicators for the installation, and where necessary, individual processes, systems and/or units, and measure their change over time or after the implementation of energy efficiency measures (see Sections 1.3 and 1.3.4) b. Identifying and recording appropriate boundaries associated with the indicators (see Sections 1.3.5 and 1.5.1) c. Identifying and recording factors that can cause variation in the energy efficiency of the relevant process, systems and/or units (see Sections 1.3.6 and 1.5.2)	Applicable – As part of the Energy Auditing process, key energy efficiency indicators are developed and benchmarked against industry norms for similar industries. This is embedded in the EPA guidance in relation to EPA auditing.	Proposed facility – BAT to be in place prior to commencement.
4.2.2.5 Benchmarking		
BAT 9. BAT is to carry out systematic and regular comparisons with sector, national or regional benchmarks, where validated data are available.	Applicable – As part of the Energy Auditing process, key energy efficiency indicators are developed and benchmarked against industry norms for other Indaver facilities. This is embedded in the EPA guidance in relation to EPA auditing.	Proposed facility – BAT to be in place prior to commencement.
4.2.3 Energy efficient design (EED)		
BAT 10. BAT is to optimise energy efficiency when planning a new installation, unit or system or a significant upgrade (see Section 2.3) by considering all of the following: a. The energy efficient design (EED) should be initiated at the early stages of the conceptual design/basic design phase, even though the planned investments may not be well-defined. The EED should also be taken into account in the tendering process b. The development and/or selection of energy efficient technologies (see Sections 2.1(k) and 2.3.1)	Applicable – Energy efficiency was incorporated into the design of facility. Energy efficiency has been incorporated into the overall design of the new facility and has been considered in procurement of equipment. Design will be based on Indaver's energy efficient facility in Meath in accordance with best practice.	Proposed facility – BAT to be in place prior to commencement.

c. Additional data collection may need to be carried out as part of the design project or separately to supplement existing data or fill gaps in knowledge d. The EED work should be carried out by an energy expert e. The initial mapping of energy consumption should also address which parties in the project organisations influence the future energy consumption and should optimise the energy efficiency design of the future plant with them. For example, the staff in the (existing) installation who may be responsible for specifying design parameters.	Energy Audits completed in 2017 for the Indaver facility in Meath highlighted opportunities for energy saving and these measures will be incorporated into the design and operation of the proposed facility. Energy audits will be completed for the proposed facility once operational. Measures suggested in these annual audits will be taken under full consideration for the following year.	
4.2.4 Increased process integration		
BAT 11. BAT is to seek to optimise the use of energy between more than one process or system (see Section 2.4), within the installation or with a third party.	Applicable – Waste heat from the incineration process will be re-used in the Waste Heat boiler for generating electricity.	Proposed facility – BAT to be in place prior to commencement.
4.2.5 Maintaining the impetus of energy efficiency initiatives		
BAT 12. BAT is to maintain the impetus of the energy efficiency programme by using a variety of techniques, such as: a. Implementing a specific energy efficiency management system (see Section 2.1 and BAT 1) b. Accounting for energy usage based on real (metered) values, which places both the obligation and credit for energy efficiency on the user/bill payer (see Sections 2.5, 2.10.3 and 2.15.2) c. The creation of financial profit centres for energy efficiency (see Section 2.5) d. Benchmarking (see Section 2.16 and BAT 9)	Applicable – a number of these measures are included in the design of the facility and have been addressed above including management systems, real time monitoring of energy usage, building automation systems, etc. Additional measures may be considered as part of continual improvement programme.	Proposed facility – BAT to be in place prior to commencement.

e. A fresh look at existing management systems, such as using operational excellence (see Section 2.5) f. Using change management techniques (also a feature of operational excellence, see Section 2.5)	Energy audits will be completed for the proposed facility once operational. Measures suggested in these annual audits will be evaluated for implementation for the following year. 'Management of Change' system to be implemented at the site. This will include proposals for change, as well as stream lining decisions to speed up implementation of improvements. Energy efficiency targets will form part of the EMS and will be reported annually in the AER.	
4.2.6 Maintaining expertise		
BAT 13. BAT is to maintain expertise in energy efficiency and energy-using systems by using techniques such as: a. Recruitment of skilled staff and/or training of staff. Training can be delivered by in-house staff, by external experts, by formal courses or by self-study/development (see Section 2.6) b. Taking staff off-line periodically to perform fixed term/specific investigations (in their original installation or in others, see Section 2.5) c. Sharing in-house resources between sites (see Section 2.5) d. Use of appropriately skilled consultants for fixed term investigations (e.g. see Section 2.11) e. Outsourcing specialist systems and/or functions	Applicable – Facility will be staffed by suitably skilled and qualified staff. All staff will be given necessary training to complete their duties with additional training for energy management as required depending on role.	Proposed facility – BAT to be in place prior to commencement.

4.2.7 Effective control of processes		
BAT 14. BAT is to ensure that the effective control of processes is implemented by techniques such as: a. Having systems in place to ensure that procedures are known, understood, and complied with (see Sections 2.1(d)(vi) and 2.5) b. Ensuring that the key performance parameters are identified, optimised for energy efficiency, and monitored (see Sections 2.8 and 2.10) c. Documenting or recording these parameters (see Sections 2.1(d)(vi), 2.5, 2.10 and 2.15)	Applicable – The facility will be operated in accordance with site procedures. These will take into account of energy efficiency principles where appropriate, and all staff will be fully trained in these procedures. The process is controlled by an interface computer system which allows for fine tuning of the process and the monitoring of all process parameters in order to optimise efficiency.	Proposed facility – BAT to be in place prior to commencement.
4.2.8 Maintenance		
BAT 15. BAT is to carry out maintenance at installations to optimise energy efficiency by applying all of the following: a. Clearly allocating responsibility for the planning and execution of maintenance b. Establishing a structured programme for maintenance based on technical descriptions of the equipment, norms, etc. as well as any equipment failures and consequences. Some maintenance activities may be best scheduled for plant shutdown periods c. Supporting the maintenance programme by appropriate record keeping systems and diagnostic testing d. Identifying from routine maintenance, breakdowns and/or abnormalities possible losses in energy efficiency, or where energy efficiency could be improved e. Identifying leaks, broken equipment, worn bearings, etc. that affect or control energy usage, and rectifying them at the earliest opportunity.	Applicable – A comprehensive preventative maintenance regime will be implemented at the facility operations. This includes maintenance of all main process equipment. Appropriate records are kept and opportunities for energy efficiency improvements identified and communicated.	Proposed facility – BAT to be in place prior to commencement.

4.2.9 Monitoring and measurement		
BAT 16. BAT is to establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of operations and activities that can have a significant impact on energy efficiency. Some suitable techniques are given in Section 2.10	Applicable - The facility will be operated in accordance with documented procedures. These will take account of energy efficiency principles where appropriate. Staff will be fully trained on the relevant procedures. Energy use monitoring will be undertaken, and energy databases will be established in order to demonstrate areas of greatest energy use. This will be controlled under the facility's EMS.	Proposed facility – BAT to be in place prior to commencement.
4.3 Best available techniques for achieving energy efficiency in energy-using systems, processes, activities, or equipment		
4.3.1 Combustion		
BAT 17. BAT is to optimise the energy efficiency of combustion by relevant techniques such as: • Those specific to sectors given in vertical BREFs • Those given in Table 4.1 (of the BREF document).	Applicable – The principle process at the facility is combustion. The thermal energy generated by burning the waste in the furnace will be transformed into electricity using a conventional steam cycle. This will consist of a boiler to generate steam, a steam turbine across which the steam will be expanded to produce motive power and a condenser to condense the steam and dissipate the low-grade waste heat. The steam boiler will operate to 53 bar and 420°C, which are optimised steam	Proposed facility – BAT to be in place prior to commencement.

	parameters for electricity generation from waste incineration. The boiler outlet temperature for the proposed development will be 180°C and is considered BAT. Such a temperature is required for the evaporation of excess water in the process and the minimisation or avoidance of liquid effluent. Some 85% of the energy produced by the combustion of waste will be recovered as steam in the boiler.	
4.3.2 Steam Systems		
BAT 18. BAT for steam systems is to optimise the energy efficiency by using techniques such as: • Those specific to sectors given in vertical BREFs • Those given in Table 4.2 (of the BREF document).	Applicable The boiler outlet temperature for the proposed development will be 160°C and is considered BAT. Such a temperature is required for the evaporation of excess water in the process and the minimisation or avoidance of liquid effluent. The boiler will consist of a number of empty passes and a final pass with tube bundles. The empty flue gas passes will be constructed from membrane walls without obstructions such as tube banks. The empty passes will allow heat transfer from the flue gas to the evaporating water in the membrane walls mainly by radiation. There will be no tube bundles in	Proposed facility – BAT to be in place prior to commencement.

	this section of the boiler as the fly ash will be sticky at temperatures above 650°C, and would quickly deposit on, and foul the surfaces.	
4.3.3 Heat Recovery		
BAT 19. BAT is to maintain the efficiency of heat exchangers by both: a. Monitoring the efficiency periodically, and b. Preventing or removing fouling	Applicable – Steam cycle heat exchangers including waste heat steam boiler, condenser, and economiser. Processing temperatures and pressure are monitored continuously using the Automated Control System. This will provide an indication of possible fouling or damage to the heat transfer surfaces. Annual inspection of boiler tubes will be undertaken during shut down. Boiler tubes will be inspected for fouling or corrosion. Preventative maintenance will be undertaken.	Proposed facility – BAT to be in place prior to commencement.
4.3.4 Cogeneration		
BAT 20. BAT is to seek possibilities for cogeneration, inside and/or outside the installation (with a third party).	Applicable – the facility will be using waste heat from the furnace to generate electricity in the Waste Heat Boiler.	Proposed facility – BAT to be in place prior to commencement.
4.3.5 Electrical Power Supply		
BAT 21. BAT is to increase the power factor according to the requirements of the local electricity distributor by using techniques such as those in Table 4.3 (of the BREF document), according to applicability (see Section 3.5.1).	Applicable – Motors, Fans and Compressors will generally be fitted with variable speed drives where practical to minimise losses. All equipment is operated within the rated voltages.	Proposed facility – BAT to be in place prior to commencement.

BAT 22. BAT is to check the power supply for harmonics and apply filters if required (see Section 3.5.2)	Applicable – Energy monitoring is installed at the main incoming supply to the facility to monitor energy consumption and harmonic content. Measures may be installed to filter harmonic content as required.	Proposed facility – BAT to be in place prior to commencement.
BAT 23. BAT is to optimise the power supply efficiency by using techniques such as those in Table 4.4 (of the BREF document), according to applicability.	Applicable - At design stage, each unit operation has been assessed for energy efficiency and factors such as location of high electrical load items relative to supply connection point, sizing of electrical transformers etc have been incorporated into the design. All measures listed in Table 4.4 have been incorporated and are set out in the design standards for the facility.	Proposed facility – BAT to be in place prior to commencement.
4.3.6 Electric motor driven sub-systems		
BAT 24. BAT is to optimise electric motors in the following order (see Section 3.6): 1. Optimise the entire system the motor(s) is part of (e.g. cooling system, see Section 1.5.1) 2. Then optimise the motor(s) in the system according to the newly-determined load requirements, by applying one or more of the techniques in Table 4.5 (of the BREF document), according to applicability 3. When the energy-using systems have been optimised, then optimise the remaining (non-optimised) motors according to Table 4.5 (of the BREF document) and criteria such as: • Prioritising the remaining motors running more than 2000 hrs per year for replacement with EEMs	Applicable – Electric motors used in the main waste handing facility include those used in the compressors, HVAC systems, pumps, fans, etc. Energy efficient electric motors are used throughout the facility and are sized accordingly. Motors are fitted with variable speed drives to minimise losses where practical. All measures listed in Table 4.5 have been incorporated where practical. Direct coupling employed for electric motors.	Proposed facility – BAT to be in place prior to commencement.

• Electric motors driving a variable load operating at less than 50 % of capacity more than 20 % of their operating time and operating for more than 2000 hours a year should be considered for equipping with variable speed drives.		
4.3.7 Compressed air systems (CAS)		
BAT 25. BAT is to optimise compressed air systems (CAS) using the techniques such as those in Table 4.6 (of the BREF document), according to applicability.	Applicable – 3 no. compressors to be installed at the new facility. These will operate on a 2 duty – 1 standby basis. The compressors will have variable speed drives where practical to minimise losses and be optimised for energy efficiency. All compressors are high energy efficiency units with sizing of pipework optimised to minimise losses due to friction etc, as listed in table 4.6. The facility will contain all new plant and as such high efficiency equipment will be selected. In the event of replacements or upgrades, high efficiency systems will also be used in compliance with BAT.	Proposed facility – BAT to be in place prior to commencement.
4.3.8 Pumping Systems		
BAT 26. BAT is to optimise pumping systems by using the techniques in Table 4.7 (of the BREF document), according to applicability (see Section 3.8)	Applicable – Pumps will be required across the site and will include the following main pumping systems: - Feed water pumps (boiler feed – from the feed water tank to the boiler drum);	Proposed facility – BAT to be in place prior to commencement.

	- Condensate pumps (pumping water from the condensate tank to the condensate flash tank); and - Process water pumps. The pumping systems are designed for energy efficiency. These are sized correctly and are fit for purpose. The design, operation and control, generation and distribution of the pumping systems employs and will employ the techniques outlined in Table 4.7. Pumps have variable speed drives where practical to minimise losses and be optimised for energy efficiency. The pumping systems will be controlled using the Automated Control System.	
4.3.9 Heating, ventilation, and air conditioning (HVAC) systems		
BAT 27. BAT is to optimise heating, ventilation, and air conditioning systems by using techniques such as: • for ventilation, space heating and cooling, techniques in Table 4.8 (of the BREF document) according to applicability • for heating, see Sections 3.2 and 3.3.1, and BAT 18 and 19 • for pumping, see Section 3.8 and BAT 26 • for cooling, chilling, and heat exchangers, see the ICS BREF, as well as Section 3.3 and BAT 19	Applicable – HVAC systems in the main waste handing building will include electrical room cooling, turbine hall extract, compressor room (cooling or ventilation as required). The HVAC systems are designed for energy efficiency. These are sized correctly and are fit for purpose. The design, operation and control, generation and distribution of the pumping systems employs and will	Proposed facility – BAT to be in place prior to commencement.

	employ the techniques outlined in Table 4.8. High efficiency HVAC units will be installed, and motors will have variable speed drives where practical to minimise losses and be optimised for energy efficiency. Maintenance of the pumping systems and optimisation will be undertaken once the facility is operational. The HVAC pumping systems are controlled using the Automated Control System.	
4.3.10 Lighting		
BAT 28. BAT is to optimise artificial lighting systems by using the techniques such as those in Table 4.9 (of the BREF document) according to applicability.	Applicable - The buildings are designed to maximise the use of natural light minimising artificial lighting. All measures listed in Table 4.9 have been incorporated. Intelligent lighting and power systems, including high efficiency LED lighting included as part of design.	Proposed facility – BAT to be in place prior to commencement.
4.3.11 Drying, separation and concentration processes		
BAT 29. BAT is to optimise drying, separation and concentration processes by using techniques such as those in Table 4.10 (of the BREF document) according to	Applicable – Instrument air and plant air to be dried following air compression.	Proposed facility – BAT to be in place prior to commencement.

applicability, and to seek opportunities to use mechanical separation in conjunction with thermal processes	Regenerative desiccant drying techniques will be used. No thermal drying.	