R1 Calculation

Formula

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

In which:

E_p	The 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	The annual energy input to the system from fuel contributing to the production of steam (GJ/year)
E_i	The annual energy imported excluding ,E-w and E-f (GJ/year)
E_w	The annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year)
0.97	The factor accounting for energy losses due to bottom ash and radiation

Definitions

E_p	E_f	E_i
• Electricity produced (self use and delivery*) • District heating produced (self use and delivery*) • Process steam produced (self use and delivery*) • Other types of heating (local heat, mobile heat accumulator) • Incineration facility self use as electricity, steam/heat are e.g. - Energy used for evaporation or injection e.g. NH_4OH injection with steam, water for cleaning purpose or waste water from wet scrubbing - Energy used for soot blowers - Steam driven devices such as pumps, compressors, vacuum pumps - Energy used for steam trace heating - Electricity used for all electrical systems (pumps, motors, fans, compressors, trace heating, control systems etc.), buildings and infrastructure (e.g. illumination, air conditioning etc.) - Energy used for re-heating of flue-gas (before catalytic reactor, after scrubber, before fabric filter) - Use of condensing energy from the steam in the flue gas - Heat for concentration process (salt concentration, spray drier) - Energy used for Apparatus, silos and buildings heating incl. warm water feed (administration, social buildings, other constructions)	• Support combustion with fuels for maintaining the minimal temperature/ incineration conditions • Start-up process with fuels starting when the steam generator is connected to the grid (usage of steam) • Shut-down process with fuels until decoupling of the steam generator with the grid (usage of steam)	• Support combustion with fuels in the start-up- and shut-down processes without connection of steam generator with the grid. • Imported energy for re-heating of the flue gases, e.g. with in duct burner (oil, gas) before catalytic reactor (SCR) or scrubber • Import of electricity (e.g. plants without turbine)

Calculation

Element	Description	Source - Swadlincote EfW Plant - HoT	Value	Unit	Conversion	GJ/yr
Ep - Elec	Annual Energy produced as electricity	Electricity Generation - Commercial Terms	164,000	MWh	3.60	590,400
EP - Heat	Annual Energy produced as heat	Heat production - Commercial Terms	0	MWh	3.60	0
Ef	Annual Energy input from fuel	N/A	1,600	MWh	3.60	0
Ei	Annual Energy input from other sources	Diesel - Annex 1	500,000	L	37.3	18650
Ew	Annual Energy input from waste	Availability Guarantee (227,500 tpa) * CV of incoming waste (10.5 MJ/kg) - Commercial Terms	1,948,896,000	MJ	0.001	1,948,896
R1						**0.8021**