4.3.1 Combustion

Combustion is a widely used process for both direct heating (such as in cement and lime manufacture, steel making) and indirect heating (such as firing steam boiler systems and electricity generation). Techniques for energy efficiency in combustion are therefore addressed in the appropriate sector BREFs. For other cases, such as combustion in associated activities, the Scope of the LCP BREF states:

'…smaller units can potentially be added to a plant to build one larger installation exceeding 50 MW. This means that all kinds of conventional power plants (e.g. utility boiler, combined heat and power plants, district heating plants.) used for mechanical power and heat generation are covered by this (LCP BREF) work.'

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.

	Techniques for sectors and associated activities where combustion is not covered by a vertical BREF				
	Techniques in the LCP BREF July 2006 by fuel type and section				Techniques in this document (the ENE BREF) by section
	Coal and lignite	**Biomass and peat**	**Liquid fuels**	**Gaseous fuels**	
Lignite pre-drying	4.4.2				
Coal gasification	4.1.9.1 4.4.2 7.1.2				
Fuel drying		5.1.2, 5.4.2 5.4.4			
Biomass gasification		5.4.2 7.1.2			
Bark pressing		5.4.2 5.4.4			
Expansion turbine to recover the energy content of pressurised gases				7.1.1 7.1.2 7.4.1 7.5.1	
Cogeneration 4.	5.5 6.1.8	5.3.3 5.5.4	4.5.5 6.1.8	7.1.6 7.5.2	3.4 Cogeneration
Advanced computerised control of combustion conditions for emission reduction and boiler performance	4.2.1 4.2.1.9 4.4.3 4.5.4	5.5.3 6	.2.1 6.2.1.1 6.4.2 6.5.3.1	7.4.2 7.5.2	
Use of the heat content of the flue-gas for district heating	4.4.3				
Low excess air	4.4.3 4.4.6	5.4.7	6.4.2 6.4.5	7.4.3	3.1.3 Reducing the mass flow of the flue-gases by reducing the excess air

	Techniques for sectors and associated activities where combustion is not covered by a vertical BREF				
	Techniques in the LCP BREF July 2006 by fuel type and section				Techniques in this document (the ENE BREF) by section
	Coal and lignite	**Biomass and peat**	**Liquid fuels**	**Gaseous fuels**	
Lowering of exhaust gas temperatures	4.4.3		6.4.2		3.1.1 Reduction of the flue-gas temperature by: • dimensioning for the maximum performance plus a calculated safety factor for surcharges • increasing heat transfer to the process by increasing either the heat transfer rate, or increasing or improving the heat transfer surfaces • heat recovery by combining an additional process (for example, steam generation by using economisers,) to recover the waste heat in the flue-gases • installing an air or water preheater or preheating the fuel by exchanging heat with flue-gases (see 3.1.1 and 3.1.1.1). Note that the process can require air preheating when a high flame temperature is needed (glass, cement, etc.) • cleaning of heat transfer surfaces that are progressively covered by ashes or carbonaceous particulates, in order to maintain high heat transfer efficiency. Soot blowers operating periodically may keep the convection zones clean. Cleaning of the heat transfer surfaces in the combustion zone is generally made during inspection and maintenance shutdown, but online cleaning can be applied in some cases (e.g. refinery heaters)
Low CO concentration in the flue-gas	4.4.3		6.4.2		
Heat accumulation			6.4.2	7.4.2	
Cooling tower discharge	4.4.3		6.4.2		
Different techniques for the cooling system (see the ICS BREF)	4.4.3		6.4.2		

	Techniques for sectors and associated activities where combustion is not covered by a vertical BREF				
	Techniques in the LCP BREF July 2006 by fuel type and section				Techniques in this document (the ENE BREF) by section
	Coal and lignite	**Biomass and peat**	**Liquid fuels**	**Gaseous fuels**	
Preheating of fuel gas by using waste heat				7.4.2	3.1.1 Reduction of the flue-gas temperature: • preheating the fuel by exchanging heat with flue-gases (see 3.1.1). Note that the process can require air preheating when a high flame temperature is needed (glass, cement, etc.)
Preheating of combustion air				7.4.2	3.1.1 Reduction of the flue-gas temperature: • installing an air preheater by exchanging heat with flue-gases (see 3.1.1.1). Note that the process can require air preheating when a high flame temperature is needed (glass, cement, etc.)
Recuperative and regenerative burners					3.1.2
Burner regulation and control					3.1.4
Fuel choice					Note that the use of non-fossil fuels may be more sustainable, even if the ENE in use is lower
Oxy-firing (oxyfuel)					3.1.6
Reducing heat losses by insulation					3.1.7
Reducing losses through furnace doors					3.1.8
Fluidised bed combustion	4.1.4.2 5	.2.3			

Table 4.1: Combustion system techniques to improve energy efficiency