Delta
Energy and Environment
Research, Analysis & Strategic Solutions

Which Cogeneration Plants Will Qualify as "High Efficiency"?

Delta Research Brief

January 2007

The benchmarks for assessing the energy savings of cogeneration projects under the EU Cogeneration Directive have now been agreed – and not all plants will qualify for policy support as a result.

In effect, the new reference value benchmark levels mean that projects which meet a certain level of energy saving will qualify for support, and those that do not, will not.

EU countries must ensure that by mid 2007 support for cogeneration schemes is only given for "high efficiency cogeneration". The Directive, passed in 2004, defines high efficiency for projects larger than 1 MWe as those that produce more than 10% primary energy savings (PES). For smaller projects, any level of PES will be sufficient.

An overall efficiency threshold must be passed. Even before the PES of a project is assessed, all schemes will be judged against an overall efficiency threshold. Most types of scheme must pass a threshold of 75% (efficiencies quoted in this Briefing are all based on the Lower Heat Value). However, if the plant has a condensing steam turbine or is based on a combined cycle then the thresholds are increased to 80%. If the scheme fails to reach the threshold efficiency it will need to be scaled back to exclude production that is deemed not to be part of the cogeneration mode.

The exact methodology for this is still under discussion, but agreement is close and, in effect, at least a part of most schemes will qualify as high efficiency. However, some countries (including the UK, the Netherlands and Belgium) will not apply this first step and will treat the installation effectively as a black-box. This results in a 'cliff-edge', whereby the *whole* cogeneration installation either passes or fails.

Once a project passes through this first qualifying stage, the new benchmarks are applied. The PES is calculated by comparing the scheme to separate electricity and heat production. The reference values for separate electricity and heat production have been extensively debated between EU member states and have now been agreed.

The efficiency assumptions for electricity production are critically important in evaluating the PES that cogeneration delivers. The agreed method is to compare the project to a large central power plant using the same fuel and built in the same year as the cogeneration plant. Thus, a biomass-fuelled cogeneration plant will be compared to a biomass power plant, and a natural gas cogeneration plant to a combined cycle gas turbine power plant.

Grid losses are also taken into account to adjust the power reference. These are differentiated according to whether the electricity is used on site or is exported, and the voltage level of grid connection.

Summary data from detailed PES calculations undertaken by Delta is shown in *Table 1* below. In our assumptions, plant efficiencies differ across prime mover products and the type of application.

Table 1: Primary Energy Savings for Different Types of Cogeneration Plant
Four of the plants detailed in this table pass the primary energy saving test. One fails and one is a borderline case.

Technology	Fuel	Year of construction	Assumed efficiencies		Primary energy savings
			Electric (%)	Heat (%)	
1 kW Stirling engine	Natural gas	2008	10	78	8% **PASS**
100 kW gas engine	Natural gas	2004	35	42	16% **PASS**
100 kW miroturbine	Natural gas	2005	23	55	11% **PASS**
5 MW gas turbine	Natural gas	2003	29	40	7% **FAIL**
2 MW steam turbine	Biomass	2003	18	46	14% **PASS**
250 kW steam turbine	Pressure let down duty	2005	8	80	10% **BORDERLINE**

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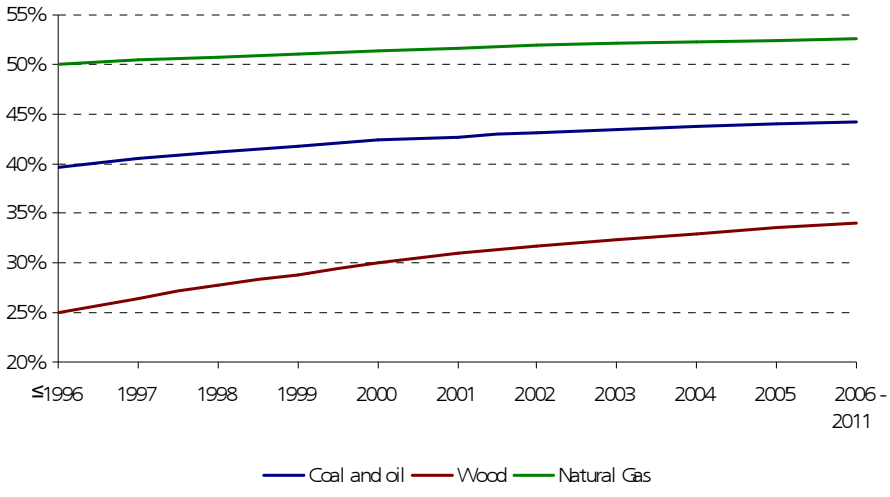
The clear implication of this system of assessing the PES of cogeneration projects is that some existing schemes may fail to achieve the qualifying threshold for support from government inventive schemes, or that schemes may have to be scaled back and lose a significant proportion of these benefits. New schemes, however, can now be designed in accordance with the new rules.

Figure 1: Reference Power Plant Values for Central Power Plants
To calculate primary energy savings a cogeneration plant is compared to a central power plant of the same fuel built in the same year.
Note: Corrections are made for ambient temperature, so reference values are lower in warmer



climates. (15°C and corrected for ambient temperature – colder higher, warmer lower).

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One type of installation where there are potential problems is that involving a small steam turbine for pressure let down; for example a steam line in a factory at 40 bar needs to be let-down to 10 bar. Due to the size of the steam turbines and the pressure drops, the turbines operate at low electrical efficiencies. This is undoubtedly better than using a pressure let-down valve since it puts the energy to use. These schemes are fairly extensive in many industries. The energy saving is clear when compared to the use of the valve, but such projects may still fail to qualify according to the PES calculation and the reference values.

The benchmark reference values for power production – shown in *Figure 1* on the previous page - have now been determined for the period 2006-11, but will be reviewed and possibly adjusted in the future. These reference plants include power consumption at the power plant, and are based on typical operating data. Reference values for boiler plant do not change over time.

Simon Minett has been heavily involved in the development of these rules and the EU Cogeneration Directive as a whole. Delta advises clients on the interpretation of these rules and the impact on existing or future cogeneration plants.

For further information, contact Delta director Simon Minett, www.delta-ee.com/contact_delta.asp.