Department for
Business, Energy
& Industrial Strategy

GUIDANCE NOTE FOR ADVANCED CONVERSION TECHNOLOGIES

Compliance with the Physical Separation Requirement in the Contract for Difference scheme

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Important considerations

This document provides guidance to Generators on how to comply with the ACT *Physical Separation Requirement*.

Should this guidance note conflict with the ‘CfD Standard Terms & Conditions’, the ‘CfD Agreement’, the Allocation Framework or any relevant legislation (together ‘the scheme rules’), such conflict should be resolved in favour of the scheme rules.

Introduction

1. A Contract for Difference (CfD) is a private law contract between a low carbon electricity Generator and the Low Carbon Contracts Company (LCCC), a Government-owned company. The electricity Generator is paid the difference between the 'Strike Price' – a price for electricity reflecting the cost of investing in a specific low carbon technology – and the 'reference price'– a measure of average GB market price for electricity. The CfD scheme provides direct funding support to renewables schemes from a levy imposed on consumer electricity bills.
2. Advanced Conversion Technologies (ACTs) including *Gasification* and *Pyrolysis* participate in the CfD scheme as one of the 'fuelled technologies'. An eligible ACT station is a generating station which generates electricity by the use of *Advanced Fuel* (gas or liquid formed by *Gasification* or *Pyrolysis* of Biomass or Waste). Most existing ACT plants produce a gaseous product (i.e. a mixture of methane, hydrogen, carbon monoxide, carbon dioxide and other hydrocarbon gases). However, there are some processes in development that either produce combustible liquids or mixtures of combustible liquids and gases.
3. The Government has introduced two new criteria that will apply to ACT Generators applying for CfD support from the third CfD allocation round. These are a minimum efficiency of the conversion process (ACT Efficiency) and a requirement for physical separation of the synthesis process from the *combustion* process. This guidance document focusses on the second criterion according to which plants must meet the *Physical Separation Requirement* (*PSR*) as defined in the Glossary.
4. Requiring the synthesis and *combustion* processes to be separated ensures clear distinction between ACT and less advanced processes that are closer to conventional boiler technologies such as dedicated biomass and energy from waste (which is only eligible for the CfD scheme with combined heat and power). The *PSR* will help in directing support to more efficient ACT processes and not to other conventional technologies.
5. This document is a technical guidance note produced as part of the third allocation round intended to provide guidance for CFD applicants on the *Physical Separation Requirement* and how developers can comply with it. Developers will be required to provide evidence to *National Grid* when applying in the form of a *process flow diagram* which will then be reviewed to ensure the design of their facility is likely to be compliant.

Glossary

This explains the key terms used in this Guidance, please note that some of these terms have the same meaning in 'CfD Standard Terms & Conditions' or 'CfD Agreement' and in that case this is noted by an asterix.

Advanced Fuel* means gaseous or liquid fuel which is produced directly or indirectly from the *Gasification* or the *Pyrolysis* of: (i) Waste; or (ii) Biomass, provided that, in the case only of a gaseous fuel, such fuel must have a gross calorific value (when measured at 25 degrees Celsius and 0.1 megapascals at the inlet to the *Combustion Chamber*) which is at least 2 megajoules per cubic metre

Ashes are solid residue which remains after the complete *combustion* of a fuel

Combustion is the stoichiometric oxidation of a substance to produce carbon dioxide and steam.

Combustion Chamber* means part of a Facility, the Facility Generation Technology of which is Advanced Conversion Technology, in which *Advanced Fuel* is combusted.

Compression Unit* means mechanical device, passage through which causes the pressure of an *Advanced Fuel* to increase.

Gasification* means the substoichiometric oxidation or steam reformation of a substance to produce a gaseous mixture containing two or more of the following: (i) oxides of carbon, (ii) methane and (iii) hydrogen.

LCCC is the Low Carbon Contracts Company.

National Grid is the Delivery Body for Electricity Market Reform (EMR). Part of this role includes the qualification of applicants and the allocation of Contracts for Difference (CfDs) in accordance with the CfD legislative framework and a number of Department for Business, Energy and Industrial Strategy (BEIS) documents that are specific to each Allocation Round.

Physical Separation Requirement (PSR)* means:

With effect from the Agreement Date, the Generator undertakes to the CfD Counterparty to ensure that at all times the *Synthesis Chamber* and the *Combustion Chamber* shall be separated by a pipe or conduct:

(A) which is used for transporting the *Advanced Fuel* produced in the *Synthesis Chamber* to the *Combustion Chamber*;

(B) which will include at least one connection that allows for sampling of the *Advanced Fuel*;

(C) within which no *combustion* will occur; and

which has an operating *Compression Unit* or *Purification Unit* within it or connected to it. (the "*Physical Separation Requirement*").

Prime Mover is a machine (or component of a machine) that converts energy from *Advanced Fuel* into mechanical energy (shaft power).

Process Flow Diagram is a flowchart that illustrates the general flow of plant processes and the relationships between the major components of the advanced conversion plant. Typically, it shows major equipment, piping, process flow direction, valves and bypasses, among other information.

Purification Unit* means a mechanical device (other than one used wholly or mainly for the purpose of removing ash) that removes solids, liquids, gases or vapours from an *Advanced Fuel*;

Pyrolysis* means the thermal degradation of a substance in the absence of any oxidising agent (other than that which forms part of the substance itself) to produce char; and a gas or a liquid, or both.

Synthesis Chamber* means that part of a Facility, the Facility Generation Technology of which is Advanced Conversion Technology, in which *Advanced Fuel* is produced.

Physical Separation Requirement

6. The *Physical Separation Requirement* (*PSR*) has been defined in latest version of the 'CfD Standard Terms & Conditions':

With effect from the Agreement Date, the Generator undertakes to the CfD Counterparty to ensure that at all times the *Synthesis Chamber* and the *Combustion* Chamber shall be separated by a pipe or conduct:

(A) which is used for transporting the *Advanced Fuel* produced in the *Synthesis Chamber* to the *Combustion Chamber*;

(B) which will include at least one connection that allows for sampling of the *Advanced Fuel*;

(C) within which no *combustion* will occur; and

which has an operating *Compression Unit* or *Purification Unit* within it or connected to it. (the "*Physical Separation Requirement*").

7. Intent to comply with the *PSR* will be determined via by a *Process Flow Diagram* (*PFD*) which will be submitted to *National Grid* as part of the CfD application process. More details can be found further on in this document.

Synthesis and Combustion Units

8. In order to comply with the *PSR*, the synthesis of the *Advanced Fuel* and the *combustion* of the *Advanced Fuel* must take place in clearly physically separated process units and not in different spaces of the same process unit.

9. The synthesis will occur in a gasifier or a pyrolizer and the *Advanced Fuel* will be transported to one (or more) *Prime Movers* (usually boilers, turbines or engines) by means of a pipe (or a piping system).

Piping

10. This pipe (or piping system) must only be used for the purpose of transporting the *Advanced Fuel* and no *Combustion* should take place inside the pipe. Therefore, the oxidant used for combusting the *Advanced Fuel* should be injected directly in the *Combustion Chamber* or at the entrance of the *Combustion Chamber*. This oxidant must never be added in the pipe transporting the *Advanced Fuel* from the *Synthesis Chamber* to the *Combustion Chamber* or in the *Purification Unit(s)* or *Compression Unit(s)*. Injection of an oxidant may be allowed prior the *Combustion Chamber* only in the case where an oxidant is needed for the purification of the *Advanced Fuel* (for example, in partial oxidation of tars).

11. Where a piping system, composed of more than one pipe, is used for transporting the *Advanced Fuel* to the *Combustion Chamber(s)*, it should comply with the following conditions:

    a. All the *Advanced Fuel* generated in the *Synthesis Chamber* and used in the *Combustion Chamber(s)* will pass through, at least, one of the *Compression Unit(s)* and/or *Purification Unit(s)* used in the process. Figures 1 and 2 show a series of compliant (Figure 1) and non-compliant configurations (Figure 2). Please note these are just intended to be examples and are not an exhaustive list of all possible configurations.

    b. In the case of configuration in Figure 2c, bypasses will be allowed for safety reasons. However, the flow of *Advanced Fuel* through the bypass should be strictly restricted to emergency situations in which malfunctioning of the *Compression Unit(s)* or *Purification Unit(s)* forces the operation of the bypass to ensure safe operation.

    c. If there is any fraction of the *Advanced Fuel* used for other purposes than electricity generation, this fraction will not need to pass through the *Compression Unit(s)* and/or *Purification Unit(s)*. Examples of this will be the generation of other products (e.g., gas to grid, heat, transportation fuels) or reuse of the *Advanced Fuel* in the synthesis process.

    d. The samples collected in the sampling point as mentioned in 6(B) will be representative of all the *Advanced Fuel* generated in the *Synthesis Chamber*.

Purification Unit and Compression Unit

12. The process should operate, a *Purification Unit* and/or a *Compression Unit* that will be located in between the *Synthesis Chamber* and the *Combustion Chamber(s)*.

13. In the case of *Purification Unit(s)*, they should remove contaminants other than *ashes* from the *Advanced Fuel*. Alkali species are not considered *ashes* for this purpose.

14. Designs including only *Purification Unit(s)* that only remove *ashes* from the *Advanced Fuel* will not be eligible. For example, a design including a mesh filter operating at high temperature and placed in between the *Synthesis Chamber* and the *Combustion Chamber(s)* in a *Gasification* process that only removes *ashes* will not be eligible. However, mesh filters operating at low temperatures and removing also heavy tars or alkali (that will become solid at low temperatures), will be eligible.

15. Some examples of *Purification Units* that could be considered eligible under these criteria are those which separate:

    - solid contaminants (tars, alkali): cyclones, electrostatic precipitators, filters
    - liquid contaminants (tars): crackers (catalytic, thermal or plasma), scrubbers

- gaseous contaminants (H_2S, carbonyl sulphide, SO_2, NH_3, NO_x, HCl): catalytic converters, absorbers, adsorbers, membranes, scrubbers

16. Please note the above is not an exhaustive list.

Process Flow Diagram

17. Intent to comply with the *PSR* will be determined via a *Process Flow Diagram* which will be submitted to *National Grid* as part of the CfD application process.

18. The *Process Flow Diagram* should at a minimum clearly identify and label the following components of the facility:

- The process unit where the *Synthesis Chamber* is placed
- The process unit(s) where the *Combustion Chamber(s)* is(are) placed
- The pipe (or piping system) that connects the process unit where the *Synthesis Chamber* is placed and the process unit(s) where the *Combustion Chamber(s)* is(are) placed
- All the *Purification Unit(s)*, if any, indicating which contaminants are removed from the *Advanced Fuel* and any material used for the operation of each *Purification Unit(s)*
- All the *Compression Unit(s)*, if any, indicating the inlet and outlet pressures
- The flow direction of the *Advanced Fuel* in the pipe (or piping system).

19. All the above must be clearly labelled on the P*rocess Flow Diagram* in order for *National Grid* to determine compliance as they cannot assume the presence of a component that is not labelled.

20. In addition, the labelling must be legible, and it must be clear which of the above is being referred to, so similar language is requested where possible.

Example Configurations

Figure 1. Examples of <u>compliant</u> configurations, showing only streams from the *synthesis chamber* ending in the *combustion chamber*; these examples do not show potential other streams which are to be used in non-combustion processes

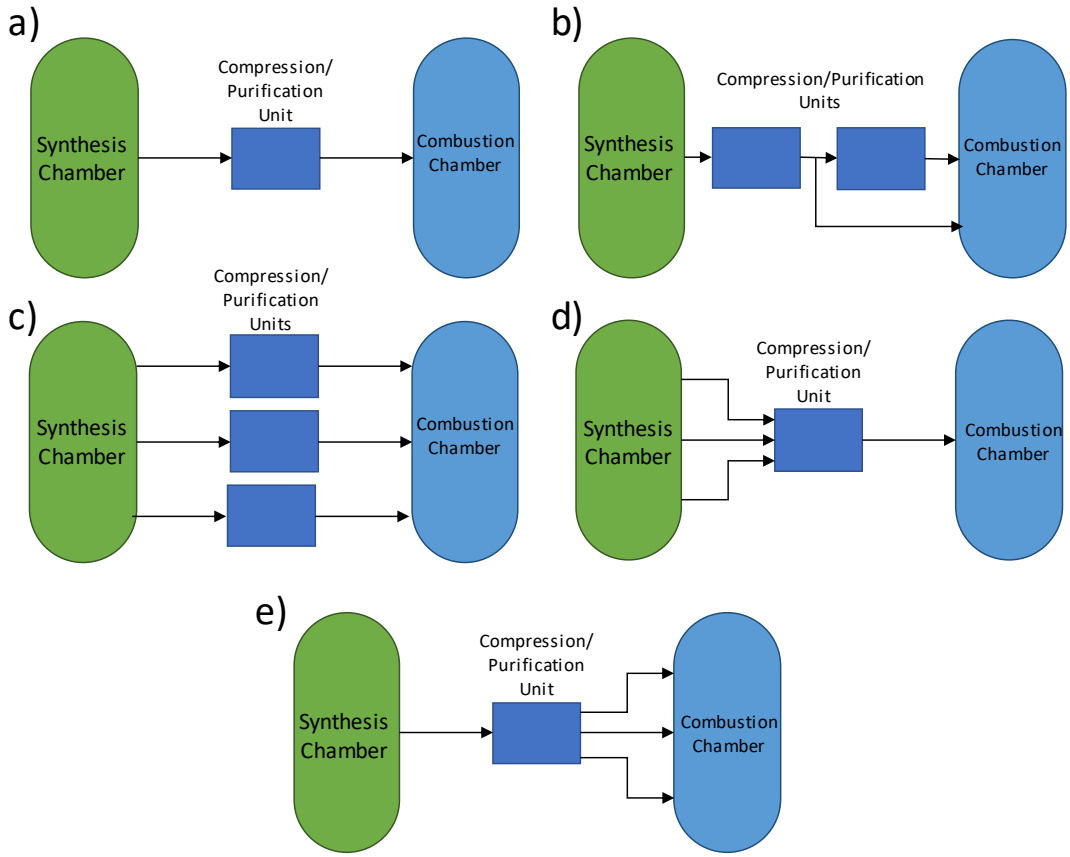
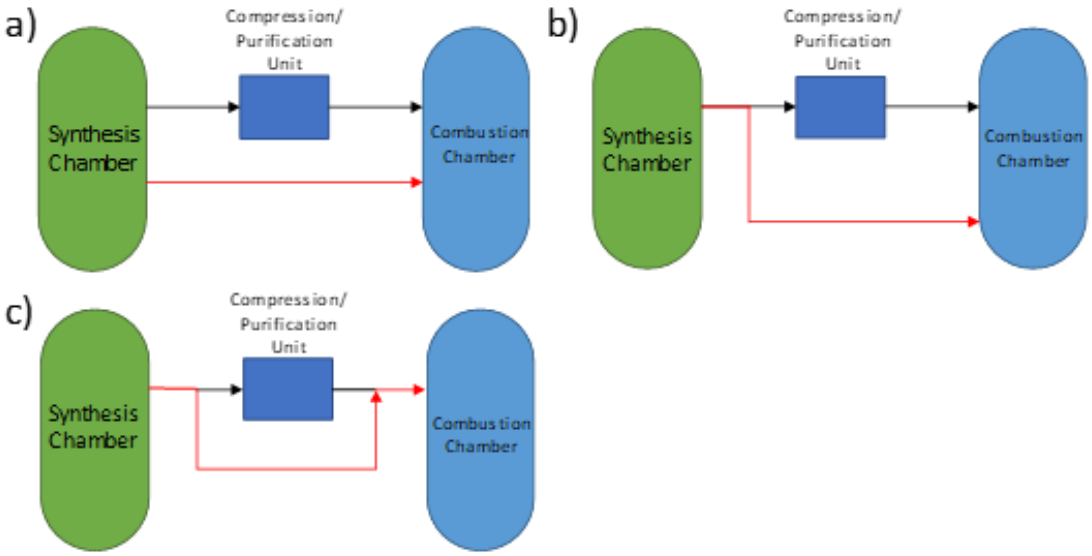


Figure 2. Examples of <u>non-compliant</u> configurations. The lines in red show paths where the *Advanced Fuel* does not pass through the *Compression Unit(s)* or *Purification Unit(s)* when being transported from the *Synthesis Chamber* to the *Combustion Chamber*



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Contact us if you have any enquiries about this publication, including requests for alternative formats, at:

Department for Business, Energy and Industrial Strategy
1 Victoria Street
London SW1H 0ET
Tel: 020 7215 5000

Email: enquiries@beis.gov.uk