# Decarbonisation Readiness (DR) Guidance

This guidance applies to new and substantially refurbished combustion power plants in England and offers practical advice for permit applications submitted to the Environment Agency.

## Introduction

Decarbonisation readiness has been introduced to support the decarbonisation of the power sector by ensuring new build and substantially refurbishing combustion power plants are ready to convert to low carbon operation.

In July 2021, the UK Government Department for Energy Security and Net Zero published a Call for Evidence ([Decarbonisation Readiness: Joint Call for Evidence](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1001949/decarbonisation-readiness-call-for-evidence.pdf)) seeking initial views on reviewing the scope of the 2009 Carbon Capture Readiness (CCR) requirements.

In March 2023, the Department for Energy Security and Net Zero conducted a consultation (Decarbonisation Readiness: Consultation) to gather and analyse responses to the previous call for evidence.

The response ([Decarbonisation Readiness Consultation Response](https://assets.publishing.service.gov.uk/media/670d4cdd92bb81fcdbe7b7db/decarbonisation-readiness-consultation-government-response.pdf)) was published in October 2024.

The [Carbon Capture Readiness](https://assets.publishing.service.gov.uk/media/5bd25883ed915d7898e7b99d/Carbon_capture_readiness_-_guidance.pdf) requirements are replaced by decarbonisation readiness and now included in the Environmental Permitting (England and Wales) Regulations 2016 (EPR). The Environment Agency is the regulator.

This decarbonisation readiness guidance applies to England only. The current CCR requirements will continue to apply in Wales.

## Who this guidance is for?

This guidance applies to new and substantially refurbished combustion power plants in England and offers practical advice for permit applications submitted to the Environment Agency.

This guidance is intended for use by:

* operators when designing their combustion power plants and preparing their application for an environmental permit
* regulatory staff
* any other organisation or member of the public seeking to understand how environmental regulations and standards are applied

The objectives of this guidance are to provide you, the operator, with the ability to demonstrate there are ‘no known barriers’ to decarbonise. This will minimise the risk of high carbon combustion power plants from becoming ‘stranded assets’

This guidance is neither definitive, nor exhaustive. It is your responsibility to assess which sections of this guidance are applicable to your circumstances.

This guidance is supported by, and should be reviewed in conjunction with, the following technical studies:

[Carbon Capture Readiness Technical Study.](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141548/carbon_capture_readiness_report.pdf)

[Hydrogen Readiness Technical Study.](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141549/hydrogen_readiness_report.pdf)

These studies provide the relevant technical information to assist you in your decarbonisation readiness assessment and are referred to within this guidance.

## 3. Overview

### 3.1 When decarbonisation readiness is required

If you are an operator of a new or substantially refurbished combustion power plant in England, the Environmental Permitting (England and Wales) Regulations 2016 require you to apply for an environmental permit. As part of this application you must demonstrate that your energy producing combustion plant (from here on referred to as ‘plant’ or ‘combustion plant’) is decarbonisation ready.

For the purposes of decarbonisation readiness, a generator is “substantially refurbished” if the cost of refurbishing the combustion plant exceeds 50% of the investment cost for comparable new combustion plant.

Decarbonisation readiness applies to the following:

* fossil fuel combustion power plants, including combined heat and power plants.
* biomass, biofuel, and biogas combustion power plants, including plants that burn biogas or biomethane from anaerobic digestion
* energy from waste plant, including those that burn fuel products produced from waste through Advanced Thermal Treatment (ATT) or Advanced Conversion Technology (ACT), such as gasification or pyrolysis, where permitted as an incinerator.
* plants which are already burning 100% hydrogen, capturing carbon dioxide, operating on blends of hydrogen, ammonia, or other low carbon fuels with methane or natural gas. No distinction is made between fossil and biogenic carbon dioxide.

As an operator, you are required to demonstrate decarbonisation readiness for the following new or substantially refurbished combustion power plants:

* sized with a rated thermal input of over 50 MWth (Environmental Permitting Regulations Schedule 1, Part 2, Chapter 1, Section 1.1, Part A1)
* sized with a rated thermal input between 1-50 MWth (Environmental Permitting Regulations Schedule 25A)
* below a rated thermal input of 1 MWth if they have a Capacity Market Agreement or participate in the balancing mechanism (Specified Generators – Environmental Permitting Regulations Schedule 25B)
* incinerating waste in a waste incineration or co-incineration plant with a capacity of greater than 3 tonnes per hour of non-hazardous waste or 10 tonnes per day of hazardous waste where electricity is produced (Environmental Permitting Regulations Schedule 1, Part 2, Chapter 1 Section 5.1 Part A1)

### 3.2 When decarbonisation readiness is not required

You are not required to demonstrate decarbonisation readiness for the following systems:

* existing combustion power plant until they undergo substantial refurbishment
* new combustion power plant with a rated thermal input below 1 MWth that are not part of another permitted installation and do not participate in the Capacity Market or have balancing services agreements
* combustion power plant that are exempt from specified generator legislation unless they are also classed as Medium Combustion Plant under an IED Chapter 2 installation
* power plant burning gas generated from landfill waste only
* power plant with a rated thermal input over 50MWth (including multiple units aggregated over 50MWth) with a nuclear safety role, under a nuclear site licence issued by the Office for Nuclear Regulation.
* power plant that has anchor plant capability, as defined in the Grid Code, issue 6, revision 27 published on 1 October 2024 by National Energy System Operator.
* Small Waste Incinerators (SWIPS) that generate electricity
* back-up plant that are operated only for maintaining power supply in an on-site emergency, where use for testing is no more than 50 hours per year and with a rated thermal input between 1 – 50 MWth (including multiple units aggregated over 50MWth).
* plant installed on an offshore platform (within the meaning of paragraph 2(2) of Part 1 of Schedule 25A)) situated on, above or below the sea adjacent to England;
* plant installed on a gas storage or unloading platform (within the meaning of regulation 2 of the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013([**3**](https://www.legislation.gov.uk/ukdsi/2024/9780348264968/schedule#f00009))) situated in the sea adjacent to England;
* mobile generators other than one referred to in paragraphs 2(1)(a) or 2(1)(b) in Schedule 25B;

### 3.3 Voluntary submissions

Operators of existing plant may wish to voluntarily apply for a permit variation to include decarbonisation readiness. For example, this could support potential investment or meet operators’ own net zero ambitions.

If the decarbonisation readiness report submitted to the Environment Agency satisfactorily meets the tests then the permit will be varied to include decarbonisation readiness conditions.

### 3.4 How to comply with decarbonisation readiness requirements

To meet the requirements of decarbonisation readiness you must demonstrate either of the following requirements:

the plant shall be ready to operate as a “qualifying complete CCS system” that can continuously operate at a minimum capture rate of 90% or,

* the plant shall be hydrogen ready and can be converted to operate on hydrogen as the primary source of fuel

For the purposes of decarbonisation readiness, “qualifying complete CCS system” means a system of plant and facilities for:

* capturing some or all of the carbon dioxide (or any substance consisting primarily of carbon dioxide) that is produced by, or in connection with, the generation of electricity by a generating station
* transporting the carbon dioxide (or substance captured) and
* disposing of it by way of permanent storage.

You may wish to consider both potential routes to decarbonisation as part of your planning. However, for the purpose of your permit application a primary preferred route must be submitted and meet the requirements. As you review and maintain your plan you may change route preference.

You will need to address four tests to demonstrate that your decarbonisation readiness complies with the requirements. They are:

space test

technical feasibility test

carbon dioxidetransport and storage test (for the carbon capture decarbonisation readiness route), or hydrogen fuel access test (for the hydrogen decarbonisation readiness route)

economic feasibility test

Your decarbonisation readiness assessment should be proportionate to the scale and complexity of the plant under development or refurbishment. You are not expected to submit designs which would be found at the level of a ‘Preliminary Front End Engineering Design’ (Pre-FEED) study. The information you provide must demonstrate that there are no fundamental barriers to pursuing carbon capture or conversion to hydrogen fuel.

### 3.5 If the requirements cannot be met

There may be a specific circumstances where operators of existing plant wish to substantially refurbish but are unable to meet the decarbonisation readiness requirements due to either

* the location of the power plant, or
* the technical characteristics of the power plant.

In this instance, the operator can provide reasoned justification to the Environment Agency and an environmental permit may still be issued.

### 3.6 Bespoke permits

A decarbonisation readiness report must be submitted as part of your application for a bespoke environmental permit. During permit determination, the Environment Agency will assess the information you present on how the space and technical feasibility tests are met. You will self-certify that the carbon dioxide transport and storage, or hydrogen fuel access, and the economic feasibility tests are met.

### 3.7 Standard rules permits

If you are applying for a relevant standard rules permit then you should also follow this guidance. You must compile a decarbonisation readiness report covering all four tests as part of your planning and preparation. However, you will not be required to submit this as part of your application and you will self-certify that all four tests have been met. You must be able to provide your decarbonisation readiness report upon request.

### 3.8 Planning and permitting interface

You may need to apply to the relevant planning authority for planning permission to carry out your activities. It is advisable to check with the local planning authority at an early stage.

You are advised to use the [pre-application advice service](https://www.gov.uk/guidance/get-advice-before-you-apply-for-an-environmental-permit#contact-the-pre-application-advice-service) to engage with the Environment Agency prior to submitting your applications for planning permission and environmental permit, so that issues which pertain to both regimes can be factored into the design of the scheme.

Planning and environmental permitting decisions are separate. Planning permission determines if the development is an acceptable use of the land. Permitting determines if an operation can be managed on an ongoing basis to prevent or minimise pollution.

You may need to consider and include in your planning application any additional land or other requirements you may need to meet decarbonisation readiness permitting requirements.

You can find further information through [the guidance available](https://www.gov.uk/government/publications/developments-requiring-planning-permission-and-environmental-permits).

## 4. Carbon capture decarbonisation readiness route

This section is applicable to decarbonisation readiness following the carbon capture route.

### 4.1 How to demonstrate carbon capture readiness in your EPR permit application with your decarbonisation readiness report

You must address four tests to be considered decarbonisation ready through carbon capture.

You must show that you have reasonable grounds to believe that all of the criteria below can be met during the lifetime of the plant. Your assessment must demonstrate:

that sufficient space is available on or near the site to accommodate the proposed carbon capture equipment

that it is technically feasible to incorporate carbon capture into the combustion power plant and detail what modifications will be required

that you have a suitable plan for carbon dioxide transport and storage

that the plan is economically feasible

For bespoke permits, you are required to submit the following documents to the Environment Agency:

a report detailing your decarbonisation plans, demonstrating how you meet the requirements of the four tests

a site plan

* a self-certification statement that the carbon dioxide transport and storage and the economic feasibility of the plan has been assessed and is viable

Where a Standard Rules permit application is made, self-assessments and self-certification statements are required for all four tests.

Instructions on what to include and how to present this evidence are provided in the following sections.

The level of detail provided in the description may be proportional to the scale of the asset, with larger plants providing more detail.

For smaller power producers, you may consider a modular carbon capture plant if the option is available and feasible.

Where the approach you propose deviates from published technical guidance you should provide reasoned justification for the Environment Agency to assess.

### 4.2 How to demonstrate that sufficient space is available on or near the site to accommodate carbon capture equipment

Your plan must demonstrate that there are no known spatial barriers which might prevent installation or operation of your chosen technology. This section details the information you need to consider to pass the space test.

You will be required to set aside adequate space for additional equipment needed for carbon capture. The space set aside should also align with the plant’s plans for carbon storage and transport. More information regarding carbon storage and transport is provided in Section 4.4.

You can refer to standard examples of plant sizes to assist you in allocating space for equipment. You may use the information provided in the [Carbon Capture Readiness Technical Study](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141548/carbon_capture_readiness_report.pdf) as a reference for footprint requirements of carbon capture plants. The space you allocate for your carbon capture plant (CCP) should be equivalent to, or exceed, the values provided in the Technical Study. Where you are proposing allocating less space, you must provide justification for this in your decarbonisation readiness assessment.

To demonstrate sufficient space is available for carbon capture, your plan must:

state the footprint of the allocated area for the CCP

justify and give evidence for the availability of adequate space for the CCP

justify that all technical requirements detailed within Section 5.3 have been addressed and can feasibly fit within the allocated space

provide an equipment list and the footprints of individual items of equipment, the detail provided should be proportional to the scale of the power plant development

list the safety considerations arising from the chosen location and corresponding mitigations, referring to any COMAH requirements where appropriate

describe the level of formal project development that has been undertaken in support of your space requirement calculations

provide adequate spacing to allow continued operation and maintenance of the combustion plant without excessive interruptions

Your site plan needs to be clear and must include the following where applicable:

all the equipment required for the CCP

modifications to the existing combustion plant, if applicable

extension and addition of balance of plant systems to accommodate carbon capture equipment requirements, if applicable

site roads for chemical unloading and equipment maintenance access

the perimeter of the plant and any associated auxiliaries

the scale used for the site plan

the location of the CCP and its proximity to the combustion plant

details of any off-site equipment and auxiliaries such as chemical storage, if applicable

the exit point for captured carbon dioxide from the site

the proposed location and footprint for the construction laydown area

All major equipment shall be easily identifiable on your site plan through labels, call outs, or other appropriate means.

### Land ownership and availability

You should assess the suitability of your chosen land for carbon capture and must ensure that no known barriers exist for the land you have chosen to build your CCP on. You must consider the following factors in your plan:

current ownership of the proposed land and any acquisition plans

timeline for land utilisation (including legal liabilities and timeframes)

potential land designations (nature reserve, SSSI, etc.)

If your selected land is not directly adjacent to the power plant, you must ensure the availability of suitable land corridors to connect to the site.

### 4.3 How to demonstrate the technical feasibility of fitting your chosen carbon capture technology

This section provides information regarding the technical feasibility details you should include in your decarbonisation readiness report. There are several methods of carbon dioxide capture, and you must consider which method is the most appropriate to fit to your power plant.

You must include:

process descriptions of proposed CCP equipment

a description of which carbon capture method is considered the most appropriate to fit to your power plant along with justification

the proposed location of the equipment on the site plan

preliminary sizing of the footprint for the CCP equipment and the sizing basis used

outline of operational specifications of the CCP equipment

the health and safety considerations of the proposed equipment, proposed mitigations and how this effects the plant design

If pursuing post-combustion carbon capture, then you are expected to use Environment Agency guidance on [Post-combustion carbon dioxide capture: emerging techniques](https://www.gov.uk/guidance/post-combustion-carbon-dioxide-capture-best-available-techniques-bat).

### Carbon capture equipment

You must include the technical details of the carbon dioxide capture process and associated equipment in your design. This includes:

the design carbon dioxide capture rate of your CCP

details of all major equipment within the CCP such as sizing, quantity, and operational requirements (temperature, pressure, flow rate)

process requirements for carbon dioxide conditioning and compression before export

the estimated demand of any utility requirements for the carbon capture equipment

the estimated demand of any chemical requirements

the cooling demand and any abstraction water demand

any tie-in points between the CCP and the combustion plant and any balance of plant equipment

the proposed export location of the captured carbon dioxide

any health and safety concerns of the chosen CCP location

any emissions arising from introducing carbon capture and their corresponding mitigations

### Thermal requirements

The CCP may require substantial thermal input, often in the form of steam. This requirement may be met through modifications to the power plant's steam cycle or the installation of separate steam generators. Where appropriate, your report must:

specify the thermal requirements of the CCP

explain how these requirements will be met through modifications or the addition of new process equipment

### Performance considerations

The introduction of the CCP may result in performance impacts to the combustion plant. Where appropriate, your report must:

describe the expected performance impacts of integrating carbon capture with the combustion plant (for example: net efficiency, electricity produced from site, and energy penalty)

describe any non-energy related performance impacts of adding the CCP. For example, turndown capacity, ramping rate or additional waste, effluent or emissions streams.

### Cooling system

The CCP and associated equipment may require additional cooling.Your report must:

confirm the proposed cooling technology

define the specification of the cooling technology for the CCP, in particular the cooling duty of the system

describe the necessary space and tie-ins for cooling equipment for the CCP

* detail any existing site permits

You should refer to the Environment Agency’s evidence on [Cooling Water Options for the New Generation of Nuclear Power Stations in the UK](https://assets.publishing.service.gov.uk/media/5a7c7688ed915d6969f450b2/scho0610bsot-e-e.pdf) when considering options for cooling. This gives an overview of UK power station cooling water systems in use in the UK and abroad.

If you are proposing a river or sea water-based cooling system, your report must include:

an estimate of the cooling water demands (flows, heat loads, and temperatures) for the CCP

the proposed cooling water source, availability, and what stages of treatment (if any) are necessary

any emissions in terms of environmental returns (flows, return temperatures, and temperature differentials)

### Water use, treatment, and disposal

Additional water requirements may be needed to meet the demands of the CCP and associated equipment. Certain water streams may require additional treatment, such as raw water pre-treatment and demineralisation, to ensure they can be used within the CCP. Your report must describe:

the water usage within the CCP in terms of operational requirements (supply and discharge rates)

any treatment requirements for these water streams

the facilities requiring water usage

the location and spacing of any water treatment plants

You may also require a wastewater treatment plant to treat the effluent streams produced through the process. Your report must describe:

the wastewater sources produced by the CCP

an estimate of the flowrate of wastewater to be treated

any treatment requirement for these wastewater streams

the location and spacing requirements of the wastewater treatment plant, if applicable

the facilities which will produce wastewater sources

If you plan to use existing on-site water and wastewater plants, then you must provide evidence of their capacity to meet the increased demands.

### Electrical loads

Significant electrical loads may be introduced through CCP equipment being fitted. Your report must include:

the estimated electrical load requirements for the CCP

provisions that spacing is available for any additional transformers, switchgears, and electrical rooms in your site plan

### Plant infrastructure

You must address the plant infrastructure in your report and site plan and where necessary make provisions to:

widen roads and add new roads to handle increased movement of vehicles

provide car parking to accommodate increased personnel and vehicle usage

indicate where major pipework and cable routes would be required

extend or introduce new administration and operational buildings to accommodate additional personnel

extend or introduce new workshops and stores to accommodate increased equipment storage capacity

identify a potential operational laydown and maintenance area and provide its location and footprint

ensure a suitable temporary laydown area for construction is available and provide its location and footprint

### Requirements for post-combustion carbon capture

This section details the additional technical feasibility criteria specific to post-combustion CCP.

You must address the handling of the flue gas exiting from the combustion plant. The flue gas exiting the combustion plant may require pressure elevation for its passage to the CCP, typically accomplished with a booster fan arrangement.

Your report must:

confirm the requirements for a booster fan

detail any energy penalties associated with the fan

estimate the space required for the fan

If it is possible to add carbon capture equipment without pressure-boosting equipment, you must provide evidence of this within your report.

You must also consider provisions for any flue gas pre-treatment necessary for the CCP operation. Your report must include:

details of all proposed flue gas pre-treatment equipment (such as selective catalytic reduction, wet scrubber installations, dry electrostatic precipitation installations, dry sorbent injection flue gas cleaning system)

the proposed volume of flue gas to be treated

details of the interconnection between the combustion plant and the CCP

### Specific requirements for pre-combustion carbon capture

This section details the additional technical feasibility criteria specific to pre-combustion CCP.

You must address the change in flue gas composition and temperatures after the pre-combustion capture process, describing any necessary changes.

You must ensure that the CCP reduces overall carbon dioxide emissions associated with the generation of power by a minimum of 90%.

You must address the utility requirements of the pre-combustion capture process and how this will affect existing or proposed equipment. Your report must include:

a process description of the utility supply system and any modifications to existing equipment

the utility requirements for the fuel conversion process

a description of the thermal integration and overall plant efficiency

the spacing required for utility supply, including modifications of existing equipment, if applicable

You must also demonstrate the power plant’s capability to operate with a hydrogen rich fuel gas. Your report must include:

confirmation of the ability to use hydrogen rich fuel gas

an estimate of the performance of the power plant operating with hydrogen fuel

any pre-treatment required for the fuel before entering the power plant

You must also explain how the power plant will meet non-carbon dioxide environmental emission limit values. You may require equipment such as selective catalytic reduction (SCR) to meet these limits.

### Specific requirements for oxy-combustion carbon capture

This section details the additional technical feasibility criteria specific to oxy-combustion CCP.

Your report must include:

a detailed process description of your plant

the anticipated oxygen generation technology

adequate spacing for equipment, interconnecting piping, and safety zoning

the utilities for the oxygen source and associated emissions penalties

If your project does not intend to generate oxygen on site, your assessment must include:

allocation of space for the reception and storage of oxygen

the anticipated frequency of deliveries

the energy and emissions associated with the generation of oxygen

### Specific requirements for carbon capture projects from solid fuels

This section details the additional technical feasibility criteria specific to solid fuel CCP.

You must consider the waste separation and disposal facilities. Use of certain fuels such as coal, petroleum coke, waste or biomass will give rise to by-product residue streams that do not occur on natural gas plants.

Your report must include:

* identification of any additional by-product streams
* procedures for handling and disposing of these by-product streams

Your plan must also address nitrogen oxides emissions control (DeNOx), particulate removal, and desulphurisation. If you require new equipment, or modifications to existing equipment you must include the relevant equipment within your plan.

Your report must include:

* the expected emissions output from using solid fuel and the equipment necessary to mitigate these emissions
* a process description of the proposed equipment
* the predicted performance of this equipment
* the compatibility of the equipment with the CCP solvent mixtures

### 4.4 How to demonstrate a suitable plan for carbon dioxide transport and storage

Your plan must address the carbon dioxide transport and storage test. For both bespoke and standard rules permits, this is a self-certified test. As part of your permit application you must provide a statement confirming that a carbon dioxide transport and storage assessment has been conducted and that your plan can feasibly accommodate the necessary carbon dioxide transport and storage quantities.

You must:

* clearly identify which carbon dioxide transport and storage route you have chosen.

identify a suitable permanent offshore geological storage site for captured carbon dioxide from your power plant and ensure a feasible direct route from your site to the storage area or.

identify a suitable carbon dioxide transport and storage network for captured carbon dioxide from your power plant and ensure a feasible route from your site to a connection point of the network

You must keep records of your assessment as evidence which must be made available to the Environment Agency upon request.

You may conduct an assessment in greater detail than outlined in this section. However, this is not a mandatory requirement of the decarbonisation readiness assessment.

As this is a self-certified test, your report only needs to include the following information:

a description of your carbon dioxide transport and storage plan. The level of detail provided in the description may be proportional to the scale of the asset, with larger plants providing more detail.

a self-certification statement confirming that your plan is feasible at the level of detail outlined below

You may choose to submit further information as part of your application. However, this shall be considered outside the scope of the assessment and will therefore not be examined by the assessor.

### Direct connection to geological storage area

The carbon dioxide transport and storage test will be self-assessed. When submitting your application, you must make a statement that you have reasonable grounds to believe that it will be technically feasible, during the lifetime of the relevant generator, for the relevant amount of carbon dioxide captured to be transported to a named storage site for disposal by way of permanent storage.

As part of your statement, you must:

identify a North Sea Transition Authority (NSTA) licensed area for deep geological storage of captured carbon dioxide and demonstrate that a feasible route exists from the proposed power plant to the storage area, or;

identify a suitable area of deep geological storage offshore for the storage of captured carbon dioxide from the proposed power plant and demonstrate that a feasibly route exists from the site to the storage area, or;

identify a suitable carbon dioxide transport and storage network to connect with, to facilitate the onward transport and storage of carbon dioxide from the proposed power plant and demonstrate that a feasible route exists from the site to the transport and storage network

Your assessment should:

identify an offshore geological storage area for carbon dioxide, and delineate the geographical extent of that area

estimate the volume of captured carbon dioxide during the lifetime of your CCP

confirm that the chosen geological storage area has sufficient capacity to accommodate your captured carbon dioxide

consider other parties’ contractual commitments to the geological storage area, using information that is available within the public domain

consider any potential technical barriers and their mitigations

ensure that a feasible route exists from the CCP to the offshore storage site

identify any obstacles within a 10km radius of the CCP and consider appropriate mitigations to these obstacles

consider potential carbon dioxide transport barriers and their mitigations

consider methods which will minimise impacts to the coastline, such as advanced boring and drilling methods

You may use open-source sites such as the [North Sea Transition Authority](https://www.nstauthority.co.uk/regulatory-information/licensing-and-consents/carbon-storage/) and the [British Geological Survey](https://www.bgs.ac.uk/geology-projects/carbon-capture-and-storage/) to support your plans.

As part of your decarbonisation readiness assessment, you should be aware that:

there is no obligation to obtain a storage license or commercial agreement, and this will be treated as a commercial decision outside of the assessments scope

the geological storage site you identify is non-binding

Selection of a geological storage site does not grant you priority for future carbon capture. You may reference existing or planned storage markets.

Your application cannot assume site identification will be outsourced during plant deployment, even for joint transport agreements. If you have evidence on which to base an outsourcing proposal, then it must be included in your plan.

Your self-assessment must also confirm the feasibility of transporting your captured carbon dioxide to the geological storage site. You cannot assume that you will be able to outsource your transport arrangements at the time of future carbon capture and storage deployment.

You are not required to provide any Environmental Impact Assessments as part of your decarbonisation readiness plan or when conducting your self-assessment.

### Connection to geological storage area via a transport and storage network

You are responsible for identifying a suitable transport and storage solution, which must be an existing or planned network.

The carbon dioxide transport and storage test will be self-assessed. When submitting your application, you must make a statement that you have reasonable grounds to believe that connection to a geological storage area via a transport and storage network.

As part of your assessment, you should:

estimate the volume of captured carbon dioxide during the lifetime of your CCP

confirm that the transport and storage network has sufficient capacity, or plans for expansion, to accommodate your captured carbon dioxide. This can be done through evidence of engagement with the relevant transport and storage network operator or Ofgem. This will ensure relevant up to date information has been used on the self-assessment.

consider the viability of connecting to the transport and storage network at the connection location proposed through the selected transport method

confirm that the final destination of your exported carbon dioxide will be an offshore geological storage site

consider other parties’ contractual commitments to the transport and storage network, using information that is available within the public domain

address and mitigate any potential technical barriers

You must also assess the feasibility of transporting the carbon dioxide to the connection location of the transport and storage network and the most appropriate method of transport. You can choose from the following transport methods:

pipeline

road

rail

ship

If you intend to use the developing Carbon Capture as a Service market you must provide a decarbonisation readiness assessment from the service provider that meets all requirements specified in this guidance.

For larger combustion power plants carbon dioxide is expected to be transported via a pipeline which is regulated by the Health and Safety Executive. This can be done as part of an industrial cluster.

If you choose a **pipeline** carbon dioxide transport method, your self-assessment must:

* ensure that a feasible route exists from the CCP to the connection point of the transport and storage network
* identify any obstacles within a 10km radius of the CCP and consider appropriate mitigations to these obstacles
* consider potential carbon dioxide transport barriers and suggest their mitigations
* consider methods which will minimise impacts to the coastline, such as advanced boring and drilling methods, if applicable

You are not required to provide any Environmental Impact Assessments as part of your decarbonisation readiness assessment.

Your application cannot assume that you will be able to outsource your onshore transport arrangements at the time of future carbon capture and storage deployment unless you are using Carbon Capture as a Service.

Smaller CCP may find it more appropriate to export their captured carbon dioxide via a non-pipeline transport method.

If you choose a **non-pipeline** carbon dioxide transport method, your self-assessment must:

* ensure that a feasible route exists from the CCP to the connection point of the transport and storage network
* estimate the amount of carbon dioxide to be exported and the tonnage capacity of your chosen transport method
* estimate the expected frequency of vehicles loading your captured carbon dioxide per day
* consider the requirements, if any, for onsite or offsite storage tanks, their capacity, footprint, location, and appropriate safety considerations
* consider the requirements, if any, for carbon dioxide liquefaction

## Hydrogen decarbonisation readiness route

This section is applicable to those wishing to submit decarbonisation readiness plans following the hydrogen conversion route. The goal of the applicant’s plans is to demonstrate a feasible conversion to operate on hydrogen as the primary source of fuel.

You must be aware that the Government Policy states that decarbonisation readiness through fuel conversion can only be demonstrated through the hydrogen route. Proposals to convert to other low carbon fuels are not currently acceptable to meet the decarbonisation readiness requirements.

Plants firing or intending to fire blends of methane with hydrogen, ammonia or other defined low carbon fuels remain in scope of the decarbonisation readiness requirements, with no distinction between fossil and biogenic carbon dioxide.

### 5.1 How to demonstrate hydrogen readiness in your permit application with your decarbonisation readiness report

You must address four tests to be considered decarbonisation ready through hydrogen conversion.

You must show that you have reasonable grounds to believe that all of the criteria below can be met during the lifetime of the plant. Your assessment must demonstrate:

that sufficient space is available on or near the site to accommodate the proposed hydrogen conversion equipment

that it is technically feasible to convert the combustion power plant to hydrogen firing and detail what modifications will be required

that you have a suitable plan for hydrogen fuel access

that the plan is economically feasible

For bespoke permits, you are required to submit the following documents to the Environment Agency:

a report detailing your decarbonisation plans, demonstrating how you meet the requirements of the four tests

a site plan

* a self-certification statement that the hydrogen fuel access and the economic feasibility of the plan has been assessed and is viable

Where a Standard Rules permit application is made, self-assessments and self-certification statements are required for all four tests.

Instructions on what to include and how to present this evidence are provided in the following sections.

The level of detail provided in the description may be proportional to the scale of the asset, with larger plants providing more detail.

Where the approach you propose deviates from published technical guidance you should provide reasoned justification for the Environment Agency to assess.

### 5.2 How to demonstrate sufficient space is available on or near the site to accommodate any equipment necessary to allow conversion to hydrogen

Your plan must demonstrate that there are no known spatial barriers which might prevent installation or operation of your chosen technology. This section details the information you need to consider to pass the space test.

You will be required to set aside adequate space for additional equipment needed for hydrogen combustion, both internally and externally, to accommodate your chosen hydrogen technology. The space set aside should also align with the plant’s plans for accessing hydrogen. More information regarding hydrogen supply is provided in Section 5.4.

You can refer to standard examples of plant sizes to assist you in allocating space for equipment. Table 11 in the [Hydrogen Readiness Technical Report](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141549/hydrogen_readiness_report.pdf) provides indicative values for the land footprint requirements for power plants and additional requirements for hydrogen infrastructure. Where you are proposing allocating less space, you must provide justification for this in your decarbonisation readiness report.

To demonstrate sufficient space is available for hydrogen conversion, your plan must:

state the footprint of the area allocated for hydrogen conversion equipment

justify and give evidence for the availability of adequate space for hydrogen conversion

justify that all technical requirements detailed within Section 5.3 have been addressed and can be feasibly fit within the allocated space

* provide an equipment list and the footprints of individual equipment. The detail provided should be proportional to the scale of the power plant development

list the safety considerations arising from the chosen location and corresponding mitigations, referring to any COMAH requirements where appropriate

describe the level of formal project development that has been undertaken in support of your space requirement calculations

Your site plan needs to be clear and must include the following where applicable:

fuel gas supply infrastructure comprising of hydrogen delivery, as well as any dual fuel provisions

hydrogen fuel gas production facilities, if applicable, including any pre-treatment conditioning, cooling, and supporting utilities

storage and handling of hydrogen, oxygen, and any utilities

modifications to the existing combustion plant

extension or addition of emissions control equipment and diluent, such as SCR reagent, additional catalyst, nitrogen, steam, or water injection

provisions to facilitate vehicle movement and access to equipment

labels for the major hydrogen conversion equipment

the perimeter of the plant and any associated auxiliaries

details of any off-site equipment and auxiliaries such as chemical storage

the entry point for hydrogen to the site and a note detailing the method of transportation

the proposed location and footprint of the operations and maintenance area

the proposed location and footprint of the construction laydown area

### Land ownership and availability

You should assess the suitability of your chosen land for hydrogen conversion and must ensure that no known barriers exist for the land you have chosen to build your hydrogen conversion equipment on. You must consider the following factors in your plan:

current ownership of the proposed land and any acquisition plans

timeline for land utilisation (including legal liabilities and timeframes)

potential land designations (nature reserve, SSSI, etc.)

If your selected land is not directly adjacent to the power plant, you must ensure the availability of suitable land corridors to connect to the site.

### 5.3 How to demonstrate the technical feasibility of conversion to a hydrogen fuel fired plant

This section provides information regarding the technical feasibility details you should include in your decarbonisation readiness report for a hydrogen fired combustion plant. Your report must include:

process descriptions of proposed equipment required for hydrogen conversion

the proposed location of the equipment, provided in the site plan

preliminary sizing of the footprint for the hydrogen conversion equipment and the sizing basis used

outline of operational specifications of the hydrogen conversion equipment

the health and safety considerations of the proposed equipment, proposed mitigations and how this effects the plant design

You may refer to the detailed technical information is described in Section 3.1-3.2 of the [Hydrogen Readiness Technical Study](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141549/hydrogen_readiness_report.pdf) for further clarifications.

You may choose to submit process flow diagrams and block flow diagrams to support your application. However, this is not an explicit requirement.

### Hydrogen firing

You must demonstrate that it will be possible to modify your combustion power plant to allow firing on hydrogen as the primary source of fuel.

You must address the following:

* ensure the location of the combustion plant does not pose any constraints towards the supply of hydrogen fuel

the volumetric capacity of firing hydrogen

materials issues and embrittlement

impact on NOx generation

leak detection and safeguarding

differences in combustion properties of hydrogen compared to the current fuel fired by the combustion plant

any utility requirements for the hydrogen readiness equipment

the startup and shutdown process

any emissions arising from hydrogen conversion and their corresponding mitigations

You must provide a statement from the Original Equipment Manufacturer (OEM) that the chosen generation equipment can already burn hydrogen as its primary source of fuel if there is no intention to replace this equipment when converting.

You must ensure that any proposed modifications to the combustion power plant are compliant with any environmental restrictions. If you fall outside the boundaries stipulated by environmental restrictions, then you must provide mitigations to bring your plans back into compliance, such as introducing selective catalytic reduction (SCR) to manage NOx emissions.

### Hydrogen storage

Depending on your specific circumstances, you may choose to store hydrogen on-site, or near to the site of, your combustion power plant. If you choose to do this, then you must include:

the chosen method of storage

the designated location and spacing allocated for hydrogen storage

the total mass of hydrogen to be stored

any health and safety considerations and their corresponding mitigations

Where hydrogen is stored in off-site geological storage facilities, these may have their own unique owner/operator (separate from the power facility) which will likely be responsible for any health and safety considerations and their corresponding mitigations.

There are various methods available for hydrogen storage, including, but not limited to:

geological storage

above ground storage;

* + liquid hydrogen
  + compressed hydrogen
  + Liquid Organic Hydrogen Carriers (LOHC)
  + Porous materials

You must provide a statement justifying your choice of storage method and why it is most suitable for your combustion plant.

This list is not exhaustive, and with ongoing technological advancements in this field, new hydrogen storage methods may emerge.

Storage of potentially hazardous materials shall be reviewed in line with hazardous substances consent, environmental permits/licences, and COMAH regulations.

### Performance considerations

The conversion to hydrogen firing may result in performance impacts to the combustion plant. Where appropriate, your report must:

describe the expected performance impacts of converting to hydrogen fuel

### Cooling system

The conversion to hydrogen may require additional cooling, particularly if hydrogen is produced onsite.Your report must:

confirm the proposed cooling technology

define the specification of the cooling technology for the combustion plant and hydrogen production facility, if applicable, the cooling duty of the system

describe the necessary space and tie-ins for cooling equipment

details of any existing site permits

You should refer to the Environment Agency’s evidence on [Cooling Water Options for the New Generation of Nuclear Power Stations in the UK](https://assets.publishing.service.gov.uk/media/5a7c7688ed915d6969f450b2/scho0610bsot-e-e.pdf) when considering options for cooling. This gives an overview of UK power station cooling water systems in use in the UK and abroad.

If you are proposing a river or sea water-based cooling system, then your report must include:

an estimate of the cooling water demands (flows, heat loads, and temperatures) for the hydrogen

the proposed cooling water source and what stages of treatment are necessary

any emissions in terms of environmental returns (flows, return temperatures, and temperature differentials)

### Water use, treatment, and disposal

Additional water requirements may be needed to meet the demands of the hydrogen fired plant and associated equipment, such as any hydrogen production facility or emission control system. Certain water streams may require additional treatment, such as raw water pre-treatment and demineralisation, to ensure it can be used within the converted power plant. Your report must discuss:

the water usage within the plant and associated equipment in terms of operational requirements (supply and discharge rates)

any treatment requirements for these water streams

the facilities requiring water usage

the location and spacing of any water treatment plants

You may also require a wastewater treatment plant to treat the effluent streams produced through the process. Your report must include:

the wastewater sources produced by the hydrogen converted plant

an estimate of the flowrate of wastewater to be treated

any treatment requirement for these wastewater streams

the location and spacing requirements of the wastewater treatment plant

the facilities which will produce wastewater sources

You may choose to reuse any existing on-site water plants to accommodate the additional demands for the hydrogen converted plant. In this case you must provide evidence that the capacity of the existing water and wastewater plants are sufficient to handle the increased demand of the hydrogen converted plant.

### Electrical loads

Modifications to the existing combustion plant and the introduction of a hydrogen production facility, if applicable, may lead to additional electrical load. Your report must include:

the estimated additional electrical load requirements

provisions that spacing is available for any additional transformers, switchgears, and electrical rooms in in your site plan

### Plant infrastructure

You must address the plant infrastructure in your report and site plan and where necessary make provisions to:

widen roads and add new roads to handle increased movement of vehicles

provide car parking to accommodate increased personnel and vehicle usage

indicate where major pipework routes would be required

extend or introduce new administration and operational buildings to accommodate additional personnel

extend or introduce new stores to accommodate increased equipment storage requirements

ensure a land plot has within the proposed site perimeter has been identified as an operational laydown & maintenance area and provide its location and footprint

ensure a suitable temporary laydown area for construction is available and provide its location and footprint

### 5.4 How to demonstrate access to hydrogen fuel

The third test that your plan must address is that of hydrogen fuel access. For both bespoke and standard rules permits, this is a self-certified test. When submitting your permit application, if you choose the HCR decarbonisation route, you will be required to include a ‘hydrogen fuel readiness certification’ statement. This will be a statement that you have reasonable grounds to believe that it will be possible, during the lifetime of the relevant plant to ensure access to a sufficient supply of hydrogen.

Methods to access a hydrogen supply include:

direct on-site production

importing from off-site production

For in-depth insights into considerations regarding hydrogen supply, please consult Section 3.5 of the [Hydrogen Readiness Technical Study](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141549/hydrogen_readiness_report.pdf).

You may choose to also include a hydrogen fuel access diagram and any letters of engagement or expressions of interest with suppliers.

You must keep a record of your assessment as evidence which must be made available to the Environment Agency upon request.

### On-site production

If you select the on-site hydrogen production option, then you must ensure that the hydrogen production method you have selected for your site is compliant with the [UK Low Carbon Hydrogen Standard](https://www.gov.uk/government/publications/uk-low-carbon-hydrogen-standard-emissions-reporting-and-sustainability-criteria) (LCHS). The LCHS sets out the criteria for hydrogen produced via:

electrolysis

natural gas reforming with carbon capture and storage

biomass and biowaste conversion to hydrogen, with and without carbon capture and storage

When carrying out your assessment you must consider the following parameters:

the location and spacing required for your hydrogen production facility

the production capacity of hydrogen at your facility

any emissions arising from the production methods and proposed mitigation strategies

any health and safety considerations and their corresponding mitigations

You are advised to refer to the Environment Agency guidance on [Hydrogen production with carbon capture: emerging techniques](file:///C:\Users\BajpaiE\Downloads\Hydrogen%20production%20with%20carbon%20capture:%20emerging%20techniques%20-%20GOV.UK%20() and [Hydrogen production by electrolysis of water: emerging techniques](https://www.gov.uk/guidance/hydrogen-production-by-electrolysis-of-water-emerging-techniques) to aid you decarbonisation readiness application. You need to be confident that you could meet the criteria required of the permittable activity should you implement the readiness plan.

### Importing from off-site production

Depending on your specific circumstances, you may decide to import hydrogen from an off-site location. If you choose this approach, then you must ensure that the hydrogen supply is compliant with the LCHS.

There are various potential methods of importing sufficient and reliable supplies of hydrogen to your site. You can choose from the following supply methods:

pipeline

rail

road

ship

If you choose to import hydrogen through a **pipeline**, your assessment must:

ensure that a feasible route exists from the combustion plant to the connection point of the pipeline

estimate the daily hydrogen fuel demand of the plant, including daily hydrogen fuel demand for any plant expansion proposals to ensure future expansion of the plant is also catered for

consider the location and spacing requirements of any above-ground installations to receive the hydrogen

consider the location, spacing requirements, and capacity of any on-site storage, if applicable

consider any health and safety considerations and their corresponding mitigations

In your plan you cannot assume that a pipeline will be constructed to meet your demands. You must reference an existing or proposed infrastructure project which you can tie into.

If you choose to import hydrogen through a **non-pipeline** method, your assessment must:

estimate the daily hydrogen fuel demand of the plant, including daily hydrogen fuel demand for any plant expansion proposals to ensure future expansion of the plant is also catered for

consider the hydrogen carrying capacity of your non-pipeline transport option. For example, a single vehicle or single freight train delivery and the minimum daily traffic required to meet the plant’s fuel demands

assess whether local road/rail connections and onsite roads/rail can accommodate the expected traffic

consider the location, spacing requirements, and capacity of any on-site storage, if applicable

consider any health and safety considerations and their corresponding mitigations

## How to demonstrate economic feasibility

The final test that you must address is the economic feasibility of your chosen decarbonisation route. For both bespoke and standard rules permits, this is a self-certified test. When submitting your permit application, you will be required to include a ‘economic feasibility certification’ statement as part of your application. This will be a statement that you have reasonable grounds to believe that it will be economically feasible during the lifetime of the relevant plant to decarbonise by your chosen route.

When you assess the economic feasibility of your plans, you must investigate the capital and operational costs associated with your proposed decarbonisation route. This investigation must conclude whether the proposed actions to reach decarbonisation readiness are economically feasible within the power plants lifetime. You do not have to demonstrate that your proposed decarbonisation readiness plan is feasible at the date of assessment.

The level of detail you conduct in your assessment should be proportional to the scale of the proposed works. Detailed economic models are not required; however, you must follow a clear methodology for estimating capital and operating costs.

During your economic feasibility assessment, you must consider the following:

capital and operating costs for your decarbonisation readiness plan

the methodology used in obtaining these figures

any assumptions used in your investigation

the economic feasibility of the proposed plan within the plant’s lifetime

You can use your own methodology to conduct the economic feasibility assessment. However, you are advised to investigate the following parameters:

assumed currency conversion rate, where required

hurdle rate/internal rate of return

fuel price

carbon price

cost of transport (construction and operation)

cost of converting to hydrogen or fitting carbon capture equipment (construction and operation – if applicable)

cost of storage

You must keep record of your assessment as evidence must be made available to the Environment Agency upon request.

## Reviewing decarbonisation readiness

Your environmental permit will include conditions about decarbonisation readiness. You must review your decarbonisation readiness every two years and if appropriate make amendments to your plans. An up-to-date decarbonisation readiness report must be made available to the Environment Agency upon request.

The purpose of the review is to encourage you to regularly assess the decarbonisation potential of your plant and to identify whether circumstances have evolved such that your original plans are no longer achievable.

The review will assess the plant’s decarbonisation potential, and the suitability and effectiveness of your chosen decarbonisation pathway. It will also assess whether any new barriers to decarbonisation have been identified, or whether any alternative decarbonisation pathways may be more appropriate.

Where appropriate you should update the approach to meeting decarbonisation readiness requirements when there are:

new technological or economic developments

wider infrastructure changes such as the installation of hydrogen or carbon capture infrastructure close to the plant

other material changes

You can propose changes to your planned approach or chosen decarbonisation technology, but you must be able to provide evidence and justification to the Environment Agency.

If your review identifies a barrier to implementing your chosen decarbonisation technology, you should explore and propose alternative solutions.

## 8. Disclosure information

### 8.1 Public register

The Environment Agency is required by law to maintain and make available public registers of information. For all permits that you apply for, the Environment Agency will place the permit application form and supporting information, the decision document and, if granted, the permit on the public register. This includes information submitted to meet the decarbonisation readiness requirements.

Under the Environmental Permitting Regulations, the Environment Agency can exclude commercial or industrial information from the public register where its confidentiality is provided by law to protect against a legitimate economic interest. However, if the information relates to an emission to the environment, the Environment Agency must place the information on the public register.

You can find more detailed information on the how the Environment Agency will hold and share the information you provide in the [EPR core guidance](https://assets.publishing.service.gov.uk/media/5fb3a39dd3bf7f37d7e7270e/environmental-permitting-core-guidance.pdf).

### 8**.2 Environmental information regulations**

Members of the public can request information from the Environment Agency under the Environmental Information Regulations 2004 (EIR). The public can also request information that has been withheld from the public register as being commercially confidential.

The Environment Agency is bound to comply with the legislation, under which there is a presumption in favour of disclosure. Therefore, you should consider the level of detail of information that you provide and whether the information provided is greater than required to conduct the decarbonisation readiness assessment.