

The Scottish Cluster and Acorn CCS Project

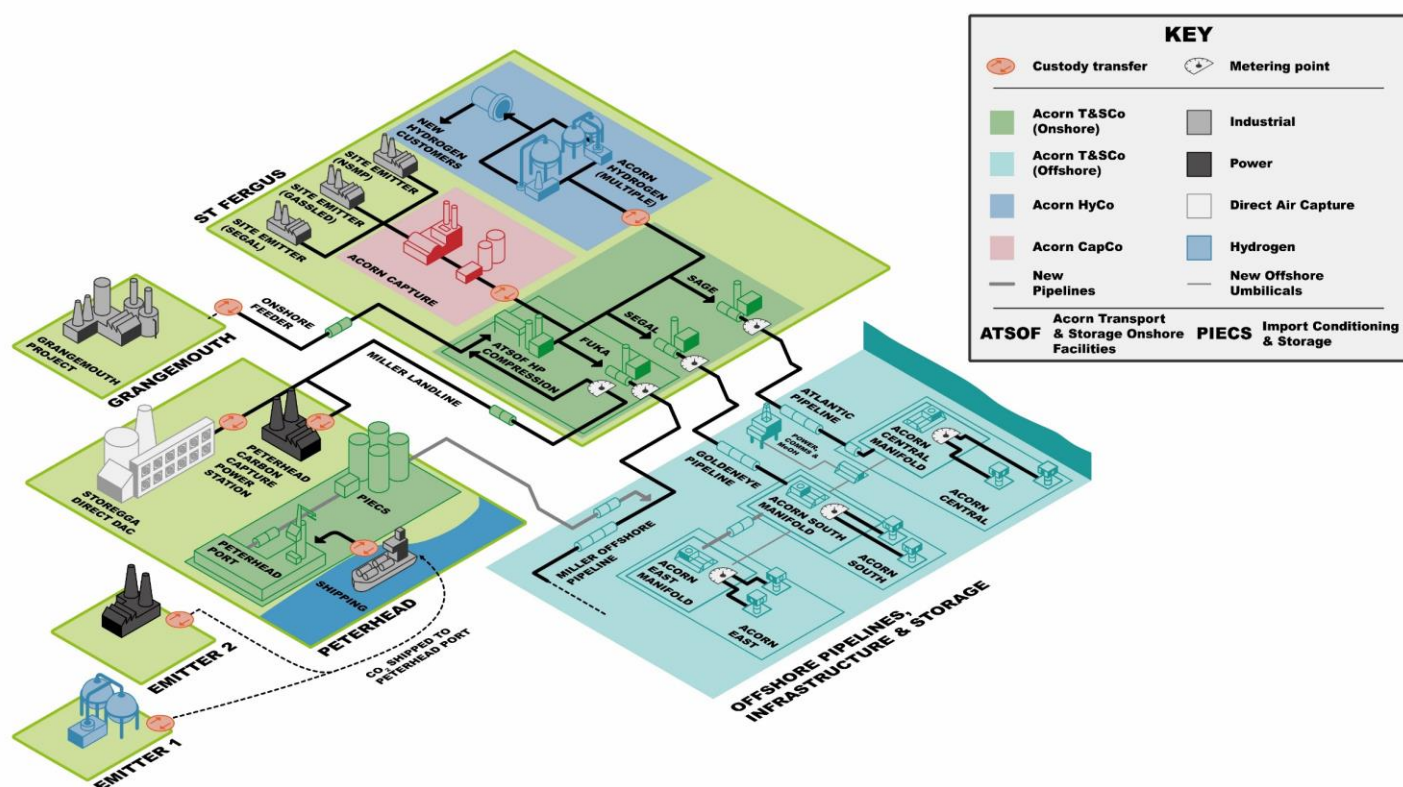


The UK Government has set a target of net zero emissions by 2050 for the UK and in Scotland that target is for 2045. We won't reach this target without decarbonising our industries. Scotland is uniquely placed to respond to this target and support the UK's net zero journey.



The Scottish Cluster unites our communities, industries and businesses to deliver CCS, hydrogen and other low carbon technologies and support Scotland, the UK and Europe to meet their net zero goals. The Scottish Cluster is expected to deliver 20,600 high value jobs in the next decade with cascading supply chain benefits. It will create low carbon jobs while sustaining vital industries that have traditionally found it difficult to reduce emissions.

Illustration of the Scottish Cluster in 2030



Acorn CCS is the flagship project for the Scottish Cluster. By making use of oil and gas pipelines that are already in place, offshore geology that is ideal for permanently storing carbon dioxide (CO₂), and a region that is embracing hydrogen as a fuel of the future, this project establishes critical CO₂ transport and storage infrastructure to support all the other Scottish Cluster decarbonisation projects.



The Scottish Cluster is currently being reviewed by the UK Government as part of the UK Carbon Capture and Storage (CCS) Cluster Programme, to support its delivery by the mid 2020s. We are working hard to deliver this important first project in line with this timescale to establish the North East of Scotland as one of the UK's first CO₂ transportation and storage hubs.



FIND OUT MORE ABOUT THE SCOTTISH CLUSTER

www.backthescottishcluster.co.uk

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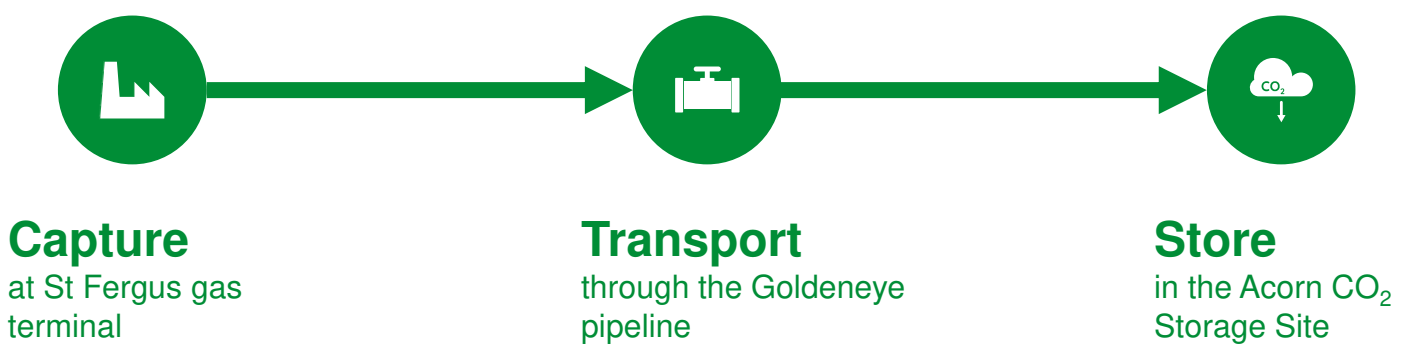




ACORN CARBON CAPTURE & STORAGE PUBLIC CONSULTATION EVENT 2021

Introducing the Acorn CCS Project

Acorn CCS captures existing CO₂ emissions from the St Fergus gas terminal and uses that CO₂ to unlock a very large CO₂ transportation and storage solution that will help industries and homes across Scotland, the UK and Europe to decarbonise.



acorn
CO₂ Storage Site

Goldeneye Pipeline

Inverness

St Fergus

Aberdeen

Grangemouth

Glasgow

Edinburgh

Teesside

Why St Fergus?

Hydrogen production hub

35%

of all natural gas currently used in the UK comes onshore at St Fergus.

Decarbonising industry

90%

of Scotland's large site emissions are within 50km of Feeder 10, a natural gas pipeline ready for reuse.

CO₂ import facilities

8 Miles

from St Fergus gas terminal, Peterhead Port offers huge development opportunities for CO₂ import.

World class storage

~30%

of the UK's CO₂ storage lies within 50km of the St Fergus pipeline corridors, enabling rapid scale up to support new low carbon technologies.

The Acorn CCS project is funded and supported by industry partners, Storegga, Shell and Harbour Energy, the UK Government and the European Union. It is led by Storegga through its wholly owned subsidiary, Pale Blue Dot Energy, with Shell working as the Technical Developer for the Acorn CCS Project.

Project partners



Government support

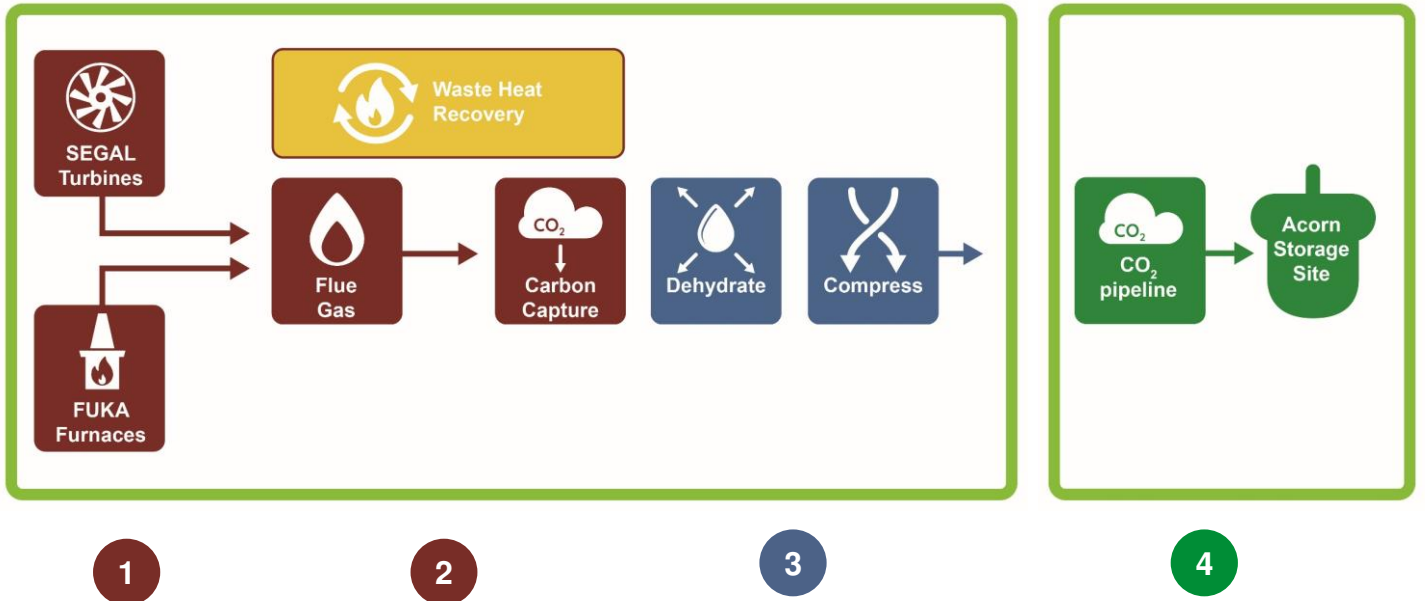


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Acorn CCS: How Carbon Capture and Storage Will Work

The Acorn CCS Phase 1 Project is a full chain carbon dioxide (CO₂) capture and storage project, which will capture an annual average in the region of 340ktonnes CO₂ per year from existing industrial emission sources at the St Fergus gas terminal, located approximately 60km north-east of Aberdeen. The process by which CO₂ will be sourced, captured and transported to the Acorn CO₂ storage site offshore is described below.



- 1** The Project will capture CO₂ from existing flue gas emission sources from the gas turbines at the Shell-Esso Gas and Liquids (SEGAL) gas terminal as well as the oil and glycol heaters at the FUKA terminal. New three metre diameter ductwork will be installed to enable the transportation of flue gas collected from these source locations.
- 2** The flue gas will be transported to the Acorn CCS Carbon Capture Plant (CCP) located at the FUKA North site. Flue gas will be cooled down to the optimum temperature of 40°C for the capture process using a Direct Contact Cooler (DCC) and two new supplementary Waste Heat Recovery Units (WHRU) will be constructed. CO₂ will be captured from the flue gas in an absorber tower using an amine based solvent absorption process. Nitrogen and oxygen are vented from the top of the amine tower, while CO₂ is captured within the amine solvent. A neighbouring stripper column releases CO₂ from the solvent for onward conditioning and compression.
- 3** The captured CO₂ will then be transported to the FUKA South site for compression and conditioning at the Acorn CCS Compression Plant. The CO₂ will be subject to conditioning, to remove oxygen and water, high pressure compression and cooling to meet the specification of the existing Goldeneye pipeline. The highly compressed CO₂, now in liquid phase, will be transported along the east of the site via pipework to the Goldeneye pipeline location.
- 4** The existing Goldeneye pipeline will transport the CO₂ from onshore at St Fergus to the Acorn CCS South Storage Site, located approximately over 100 km offshore at the site of the now depleted Goldeneye Gas Reservoir. At the site, two wells will be installed to allow CO₂ to be directly injected into the Acorn CCS South Storage Site where it will be permanently and safely stored.



What Acorn CCS Looks Like Onshore

Onshore, Acorn CCS comprises 7 key components, which are referenced in the map below and illustrated on the following banner. These 7 components include:

- 1

Installation of two new supplementary Waste Heat Recovery Units (WHRU) in the SEGAL area
- 2

A flue gas collection system with installation of new ductwork from the SEGAL site
- 3

Construction of a Carbon Capture Plant (CCP) at the FUKA North site, including a vertical absorber tower.
- 4

Construction of a compression and conditioning plant at the FUKA South site
- 5

A flue gas collection system with installation of new ductwork from the FUKA site
- 6

Installation of a CO₂ pipeline along the east of the site to tie into the existing Goldeneye pipeline
- 7

Substations, including the construction of two new substations, in the southwest of the site

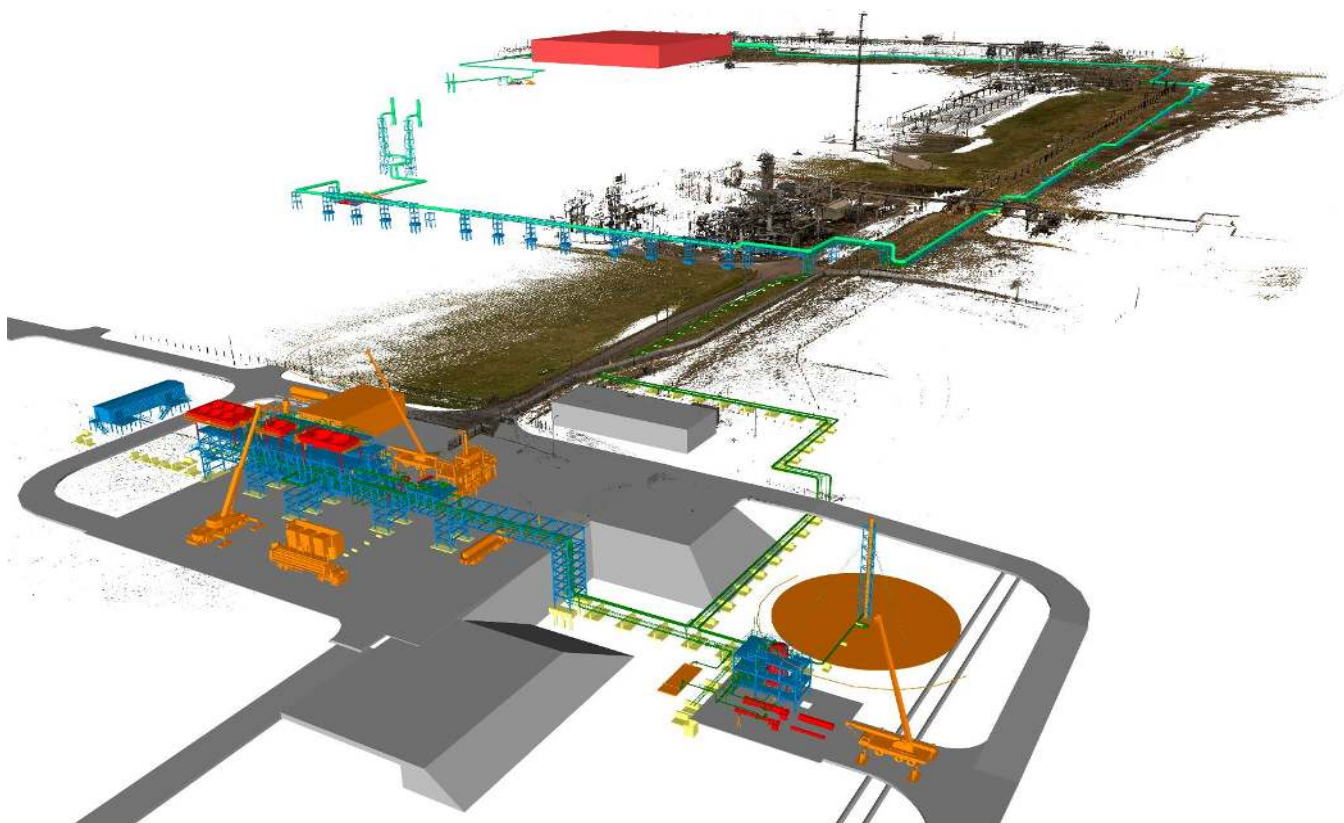


Map identifying locations of key onshore components and respective images.

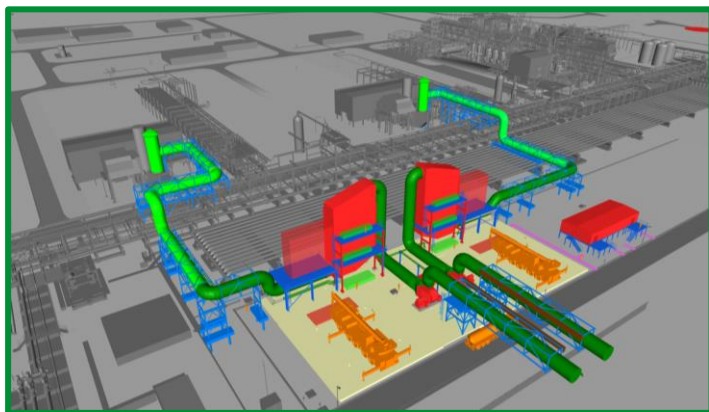
Programme

Subject to consent, construction will start in 2023 and there will be temporary use of a construction compound in the southwest of the site. The Project will become operational in 2026.

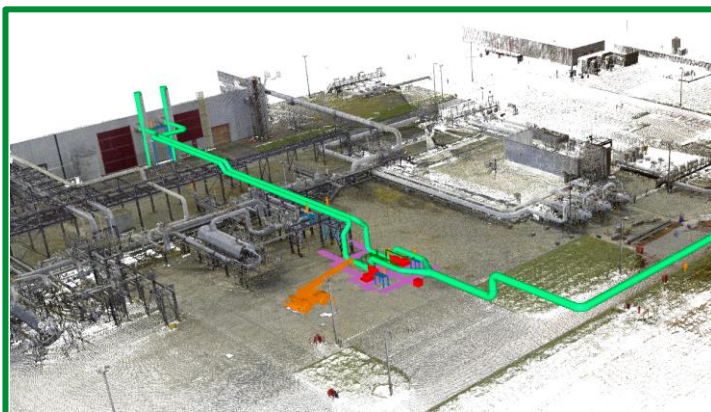
What Acorn CCS Looks Like Onshore



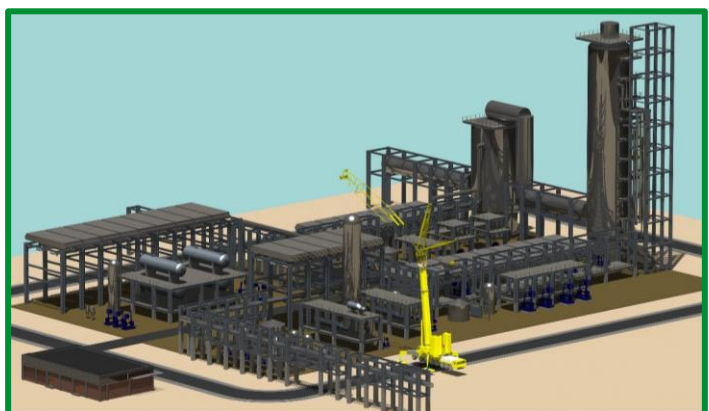
Overview of Acorn CCS Onshore



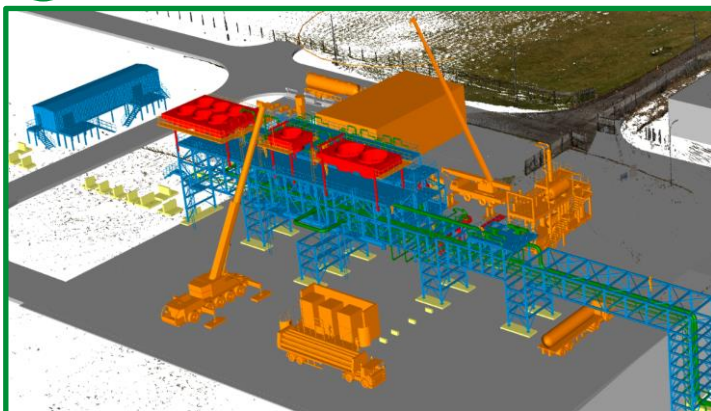
1 SEGAL Flue Gas Collection & New WHRU's



2 FUKA Flue Gas Collection



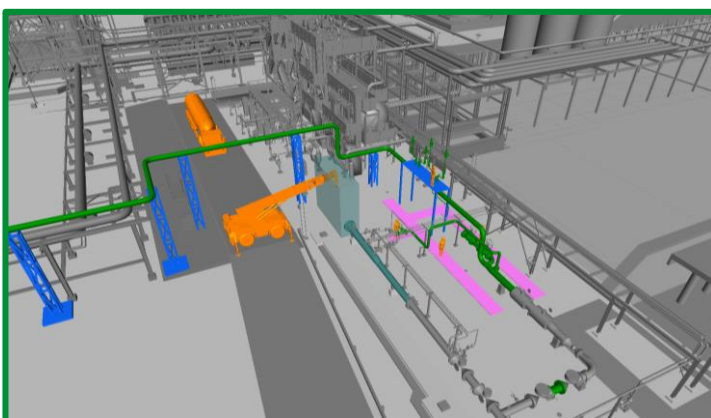
3 New Carbon Capture Plant (CCP)



4 New Compression & Conditioning Plant



5 FUKA Flue Gas ducting & CO₂ export line



6 CO₂ Export line tie-in to Goldeneye Pipeline



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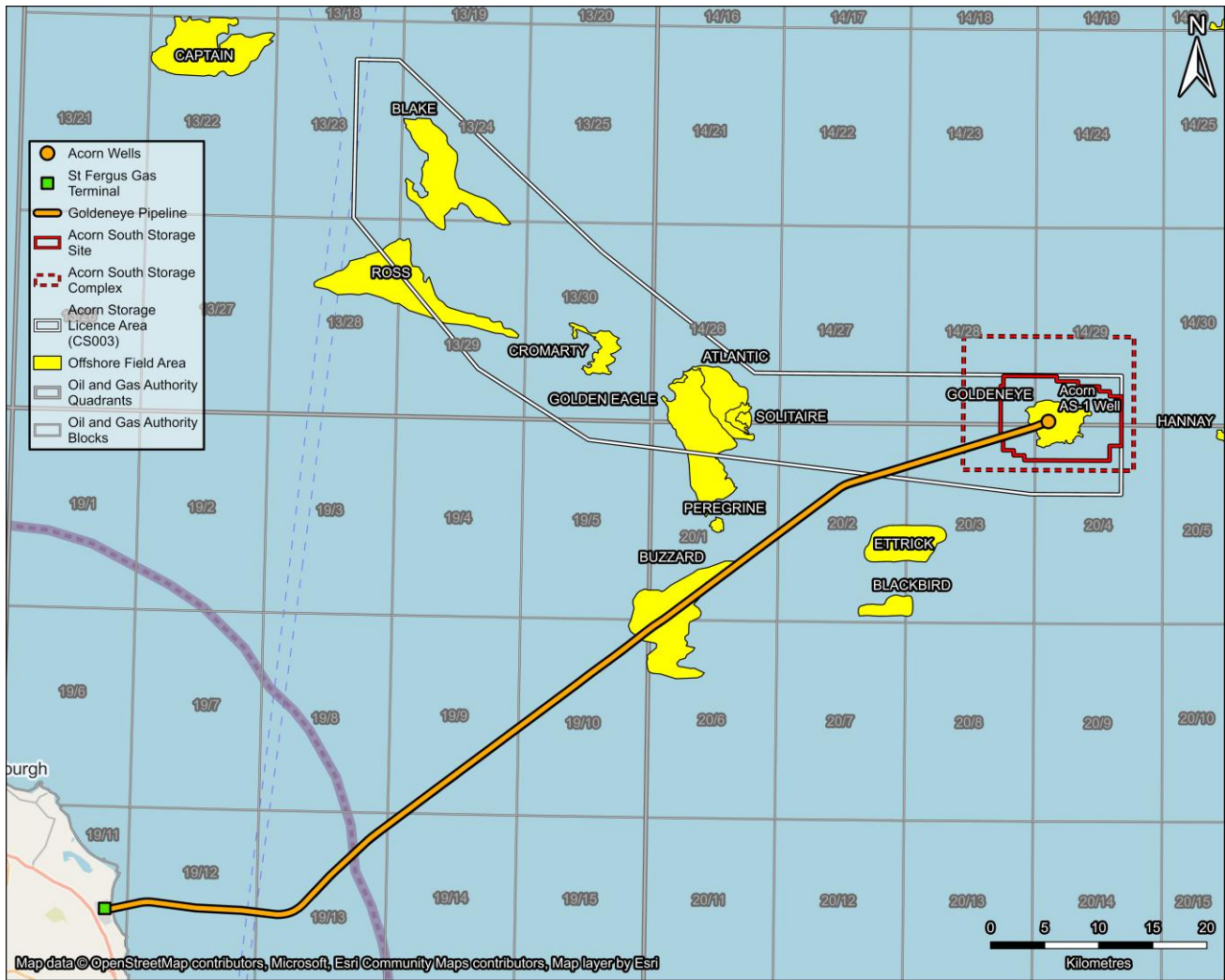
What Acorn CCS Looks Like Offshore

The Goldeneye Pipeline and Acorn CCS South Storage Site

CO₂ will be transported approximately 100km offshore via the existing Goldeneye pipeline to the site of the depleted Goldeneye gas reservoir. This depleted reservoir forms the Acorn South Storage Site.

Two new wells will be drilled in the storage site for injection of the captured CO₂ for permanent geological storage. Options are being developed for the power and controls for the new wells – with both an umbilical to a local asset and a floating local control buoy solution under consideration. All of the offshore infrastructure will be subsea.

Drilling is likely to take place in either 2023 or 2024, subsea installation between 2024 and 2025 and commissioning and first injection of CO₂ in either 2025 or 2026.



Project Location

Key components of the offshore project are:

- The reuse of the existing 102 km 20” Goldeneye pipeline from St Fergus to the Acorn South Storage Site for transportation of CO₂
- The drilling and completion of two CO₂ injection wells in the Acorn South Storage Site (formerly the depleted Goldeneye gas reservoir)
- A new buried umbilical for power and control to an existing local asset / or a new local floating control buoy – option assessment ongoing
- Seabed infrastructure protection (e.g., concrete mattresses, rock placement, grout bags) at Acorn South Storage Site



Acorn South Manifold: used for injection wells



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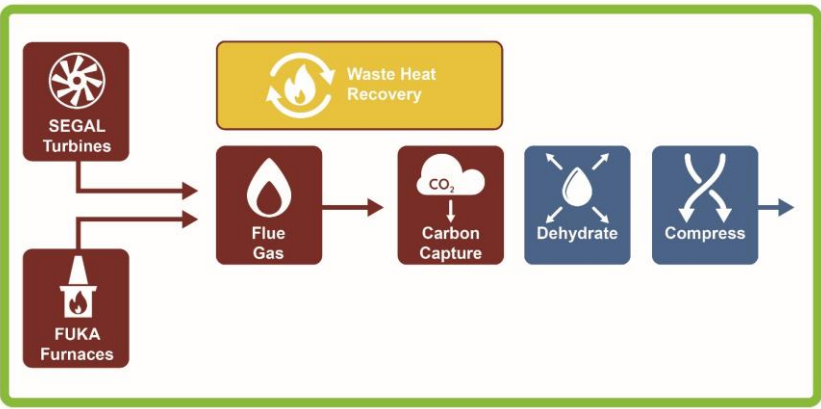




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Appraisal of Onshore Impacts

Onshore planning permission



To support the onshore planning application for Acorn CCS, an Environmental Appraisal is being undertaken. The Environmental Appraisal will be submitted to Aberdeenshire Council. Below is a summary of the work which has been undertaken to-date on the Environmental Appraisal and the planned next steps in the process.

	Detailed baseline data collection including survey work
	Production of an Environmental Appraisal Scoping Report
	Engagement with key stakeholders such as Aberdeenshire Council and SEPA, amongst others
	Assessment of the first set of onshore impacts
Now	First public consultation on emergent appraisal findings
2021	Completion of the appraisal of onshore impacts
2021	Second public consultation on the completed appraisal findings
2021	Completion of the Environmental Appraisal report for submission to Aberdeenshire Council as part of the onshore planning application

Magnitude of Impact

		Small	Medium	Large
Importance and Sensitivity of Receptor	Low	Not significant	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Matrix showing the magnitude of impact and the importance and sensitivity of receptor

The Environmental Appraisal assesses the predicted environmental impacts of the project onshore.

The assessment identifies the significance of identified potential impacts in key topic areas. Where an impact is identified, measures to avoid, reduce or minimise these impacts are considered.

The significance of potential impacts, after such measures have been considered, will be presented in the Environmental Appraisal Report. While the Appraisal is ongoing, a summary of the findings to-date is presented in the next set of boards.

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Landscape and Visual

Baseline

The site lies within an industrial facility in a rural coastal landscape locally designated as the North East Aberdeenshire Coast Special Landscape Area. The site is visible from St Fergus village, scattered residential properties, the A90 and the coastal path.

The extent of the study area and the location of representative viewpoints and photomontages has been agreed with Aberdeenshire Council.

Appraisal Update

An appraisal of the landscape and visual impacts of the Project is being undertaken and will be reported in the Environmental Appraisal.

The Appraisal will consider the appearance of all infrastructure. The most significant new bits of infrastructure on the landscape are likely to be: a tall absorber tower, the substations, and the compression and conditioning plant. These are still undergoing design refinements, but the tallest of these structures (the absorber tower) is not expected to be taller than the existing flares on site.



View of existing terminal from the public path to the south

Air Quality

Baseline

The Scottish Environmental Protection Agency (SEPA) and Aberdeenshire Council were consulted on the method proposed for the appraisal of emissions to air. Environmental assessment levels have been agreed with SEPA and these will be used to appraise the impact on air quality from the project and inform the design of any mitigation required.

Appraisal Update

An appraisal of impact to air quality using dispersion modelling is underway and will assess the following:

Impacts to sensitive ecology:

- Emissions of oxides of nitrogen (NO_x);
- Emissions of ammonia; and
- By association, acid deposition and nutrient nitrogen deposition.

Impacts to human health:

- Emissions of oxides of nitrogen (NO_x) and nitrogen dioxide (NO₂);
- Emissions of ammonia;
- Emissions of amines, nitrosamines and nitramines (N-amines).

Criteria for assessment of human health impacts

Annual mean concentration at receptor in assessment year	Change in concentration relative to Air Quality Standard (AQS) (%)			
	1%	2-5%	6-10%	>10%
<75% AQS	Negligible	Negligible	Minor	Moderate
76-94% of AQS	Negligible	Minor	Moderate	Moderate
95-102% of AQS	Minor	Moderate	Moderate	Major
103-109% of AQS	Moderate	Moderate	Major	Major
>110% of AQS	Moderate	Major	Major	Major

The Project will be designed to meet all relevant UK air quality standards. Operation of the Project will be subject to a Pollution Prevention and Control permit that is regulated by SEPA and will set stringent limits. This is the same regulatory regime used to permit the existing St Fergus gas terminals.



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Noise and Vibration

Baseline

The closest noise sensitive receptors to the Project are properties within St Fergus village and scattered residential properties around the site. The closest property is approximately 1km to the east.

The Scottish Environmental Protection Agency (SEPA) and Aberdeenshire Council have been consulted on the survey and appraisal method. A baseline noise survey was conducted in November 2020.

Appraisal Update

Noise modelling and assessment is underway, alongside engineering design. This will confirm and quantify all noise sources and appraise the construction and operation phases. The likely sources of the majority of noise include:

- Construction plant and traffic;
- Coolers, fans and pumps;
- Compressors; and
- Substations.

If a significant increase in noise level is identified, mitigation measures will be designed to reduce noise to a level acceptable to SEPA and Aberdeenshire Council. Initial modelling to date has identified that the compressors, coolers and fans at FUKA south are likely to require mitigation.

Vibration is not considered to be a significant issue because the construction plant will be over 100m from the nearest sensitive receptors.



Noise Monitoring Locations / Sensitive Receptors

Traffic and Transport

Baseline

The traffic impacts of the project will be appraised in regards to existing road users, pedestrians, cyclists and other sensitive receptors.



Traffic on route to Peterhead

Appraisal Update

Construction: The majority of traffic will approach the site from the south using the A90. Large prefabricated components will be delivered to Peterhead Port, in accordance with Transport Scotland’s Water Preferred Policy. The Project will build upon the experience of other major construction projects which have used the Port.

Abnormal load deliveries to the Site will be required for the delivery of transformers and large prefabricated components. Consultation and notification will be undertaken with Aberdeenshire Council and the police to make sure that traffic impacts on the road network are minimised and emergency access is provided at all times.

Once an estimate of construction traffic movements is determined, the percentage change to average traffic flow on the A90 will be calculated and presented in the Environmental Appraisal. Mitigation measures will be identified including the preparation of a construction traffic management plan, and the possibility of workers being transported to site by bus, where practical, to reduce construction traffic.

Operation: There will be a small increase in traffic movements due to additional employees, deliveries and waste transportation.



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Historic Environment

Baseline

Aberdeenshire Council were consulted on the historic environment baseline and the method applied to the appraisal of the historic environment.

A walkover survey has been undertaken to consider any potential impacts on the setting of historic monuments.

Appraisal Update

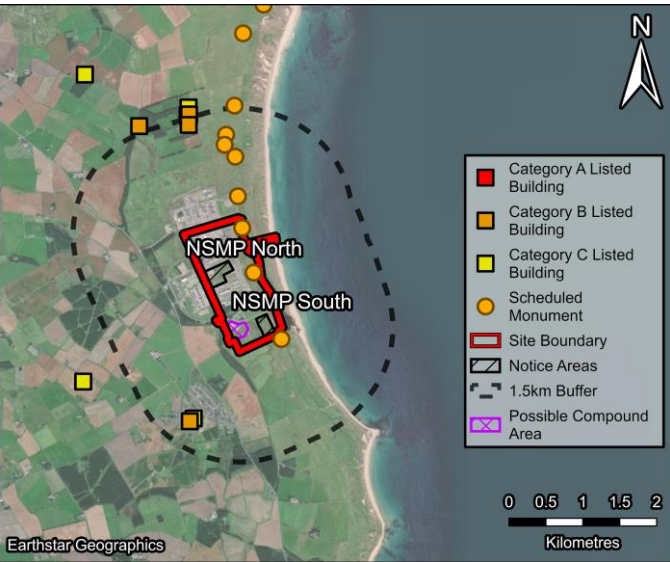
There will be no direct impacts from the Project to known designated heritage assets.

The Project has the potential to affect the setting of a single pillbox to the southeast of the gas terminal compound, but the impact is considered negligible given the industrial setting.

The listed buildings at St Fergus and Rattray House are considered sufficiently removed and screened from the Project, resulting in negligible impact to setting.

There is the potential for unknown buried archaeological features to survive within the Project area. Mitigation during construction will include an archaeological watching brief.

The ground investigations on site are ongoing, this will include an archaeologist visiting the site to check for evidence of paleo-archaeology.



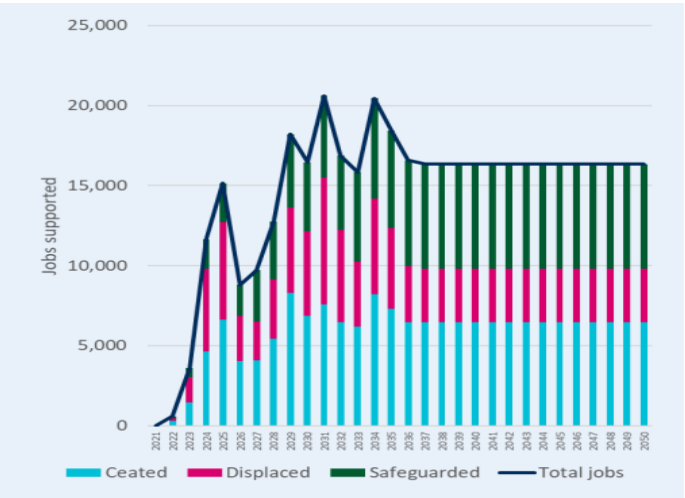
Heritage features in and around the project site.

Socio-economic

Appraisal Update

A detailed analysis has been undertaken to identify the socio-economic impacts of the Project and its wider contribution to employment as part of the Scottish Cluster.

The construction workforce required to build the Project, is estimated to generate 500 direct jobs between 2022 and 2025. The Project will also support 1,000 additional jobs and another 2,250 jobs indirectly, through its construction and operation. Wherever possible, these jobs will be sourced from the local and national workforce. Analysis has identified that the Scottish Cluster as a whole, could support an average of 15,100 jobs between 2022-2050, comprising 6,200 direct jobs and 8,900 supply chain jobs.



Jobs supported by the Scottish Cluster

CO₂ Reduction

Appraisal Update

Calculations have been completed to understand the amount of CO₂ that will be stored over the lifetime of the Project. In addition, a “whole life” carbon footprint has been prepared. This takes into account the materials and activities to build the plant, as well as emissions from ongoing operations.

It is estimated that over 500 million tonnes of CO₂ will be stored cumulatively by the Scottish Cluster between 2025 and 2050. This is equal to four times the amount of CO₂ emissions released. This will peak at just under 30 million tonnes per year, or around 8% of the UK’s 2019 CO₂ emissions.



expects to cumulatively store...

~25.5Mt of CO₂ by 2030.

~500Mt of CO₂ by 2050.



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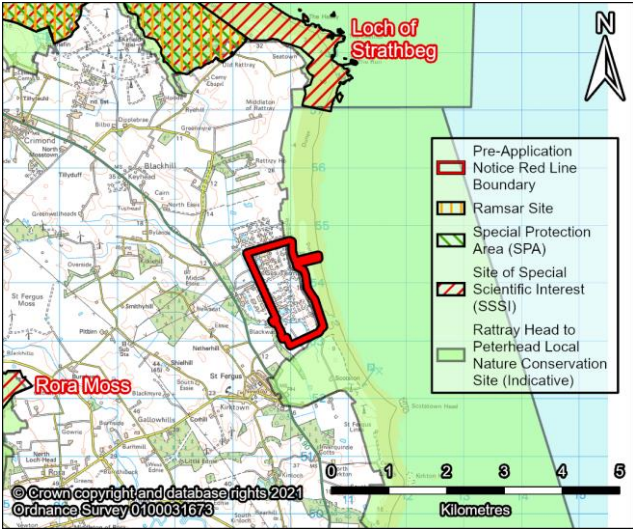
Ecology and Nature Conservation

Baseline

Aberdeenshire Council and NatureScot were consulted on the scope of the appraisal of ecology and nature conservation.

The site avoids statutory and non-statutory designated ecological sites. Loch of Strathbeg SPA/Ramsar site and SSSI are 3.8 km and 3 km north of the site respectively. There is a local nature conservation site immediately adjacent to the south and west of the site.

Surveys of habitats, birds, otters and water voles have been completed and a Habitat Regulations Appraisal will be undertaken to consider impacts on SPA bird species.



Environmental sensitivities

Appraisal Update

Construction: The project site has been selected to avoid direct impact on the Local Nature Conservation Site. The Loch of Strathbeg SPA, Ramsar site and SSSI are far enough away that disturbance to resident species is unlikely. Construction works may disturb foraging species, such as pink-footed geese, potentially causing displacement of foraging activity. There are numerous alternative foraging areas and any short term disturbance is unlikely to have a significant adverse effect on the conservation status of the population or habitat.

The clearance of the development area within the gas terminal will remove semi-improved neutral grassland, hardstanding, bare ground and amenity grassland. Mitigation will be developed to avoid or minimise impacts to common toad, common lizard and slow worm.

Operation: The air quality appraisal will identify any impacts to designated habitat due to nitrogen deposition. Increased noise from the site could result in disturbance to foraging waterfowl on nearby fields.

Hydrology

Baseline

The Project is located in the Buchan Coastal catchment, within the sub catchment of the Blackwater (a Water Framework Directive waterbody). The Blackwater drains much of St Fergus Moss and discharges into the North Sea. The Project avoids land at risk of river or coastal flooding.

Appraisal Update

Construction: Risks around leaks and spillages during construction will be effectively managed and the magnitude of any impact will be negligible. Bridge strengthening will be undertaken to support heavy vehicle usage of the Blackwater and will be considered in the Environmental Appraisal.

Operation: Wastewater streams from the Project will be treated and fed into the existing wastewater treatment facility at St Fergus Gas Terminal. Treatment will achieve existing pollution prevention and control permit water standards agreed with SEPA. The Project will also be designed to manage surface water within the existing surface water drainage system at St Fergus.

Scottish Water will meet the water demand of the Project and there will be no effect on local water supply.

Geology, Contaminated Land and Hydrogeology

Baseline

The Project site is mainly brownfield land within the existing gas terminal facility, consisting of hardstanding surfaces and fill material.

Appraisal Update

Construction: Construction activities will involve the excavation of ground and superficial deposits. Ground investigation prior to construction will be undertaken to check for contaminated land.

Operation: Geology and shallow groundwater flow that may be disturbed by construction will equilibrate over time. No long term operational impacts are identified. Mitigation measures to reduce the likelihood of a spill occurring and appropriate control measures in the event of a spill will reduce the risk to geology and soil.



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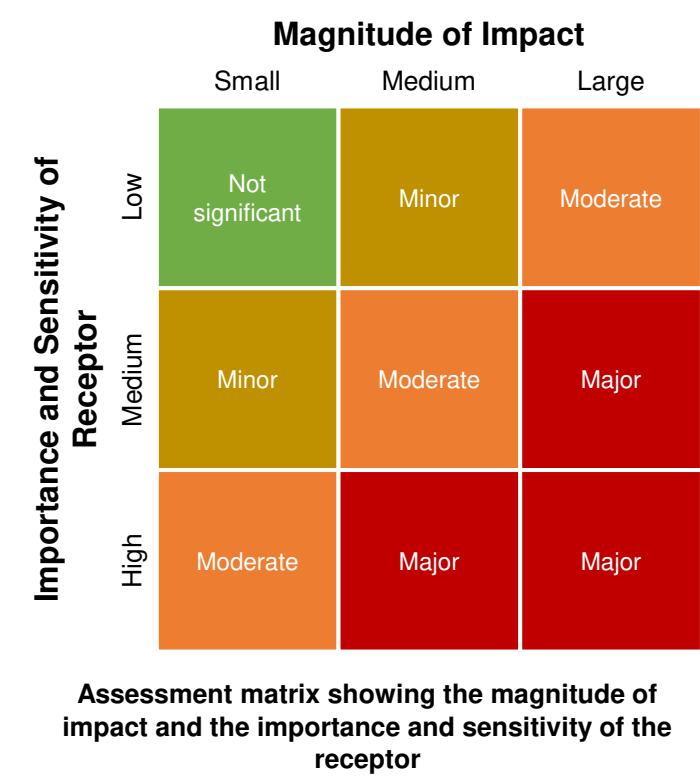
Assessment of Offshore Impacts

As part of the application for a Carbon Dioxide Storage Permit for Acorn CCS, an Environmental Statement (ES) is being produced. The ES contains the results of an Environmental Impact Assessment of the construction, operation and decommissioning of the offshore elements of the project. It is a key consent for the project.

The ES will be submitted to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), a division of the Department of Business, Environment & Industrial Strategy (BEIS). A further round of public consultation will be undertaken on the ES. Information on this will be publicised on the OPRED and project websites. Feedback from this consultation and wider engagement with stakeholders will subsequently be used to finalise the assessment.

Below is a summary of the work which has been conducted to-date on the ES as well as the next steps in the process.

	Detailed baseline data collection including survey work
	Production of an EIA Scoping Report
	Engagement with key stakeholders such as OPRED, HSE, OGA, SNH, Marine Scotland and SFF
	Detailed impact assessment of the potential offshore impacts
	Production of a draft Environmental Statement
Now	Update to the public on the emergent findings of the Environmental Statement
2021	Completion of the Environmental Statement for submission to OPRED
2021	Public consultation on the findings of the Environmental Statement, hosted by OPRED



The Environmental Statement assesses the predicted environmental impacts of the Project, as well as the potential impacts from an unplanned release of hydrocarbons or CO₂.

The assessment identifies the significance of identified potential impacts in key topic areas. Where an impact is identified, measures to avoid, reduce or minimise these impacts are considered.

The significance of potential impacts, after such measures have been considered, is presented in the Environmental Statement. A summary of these impacts is provided on the next board.



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Safely Delivering Carbon Capture and Storage

Control of Major Accident Hazards (COMAH)

- The St Fergus gas terminals are currently designated as top tier COMAH facilities, meaning they are governed by some of the strictest health and safety requirements. The Acorn CCS Project will be managed to these same standards.
- Whilst the handling of CO₂ is not currently considered a COMAH activity, we are undertaking the design development with the same approach as if it were a COMAH facility.
- The handling of CO₂ does not present the same hazards as the hydrocarbons which are currently managed at the site (i.e. it is not flammable or explosive).
- However, CO₂ does have factors which need to be carefully managed and controlled. The hazards considered at the site will change, but the need for us to manage all risks to be As Low As Reasonably Practicable (ALARP) will remain.

Pipeline Integrity

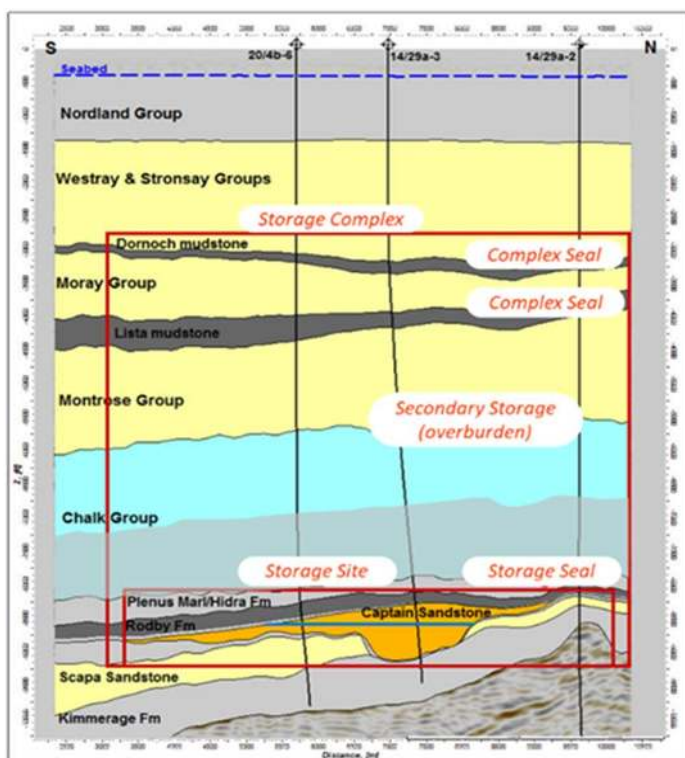


Goldeneye pipeline inspection pig

- A pipeline survey has been completed by running an inspection 'pig' along the entire length of the inside of the Goldeneye 20-inch diameter pipeline.
- The pig measure the thickness of the steel pipe and can highlight areas of corrosion that may be a concern for pipeline integrity.
- The inspection was completed in the summer of 2021 and the data gathered is currently being analysed in order to confirm the suitability of the Goldeneye pipeline for CO₂ transport.
- Prior to commencing CO₂ transport, a Pipeline Integrity Management System will be put in place to ensure that the line is maintained in a suitable condition such that any risk of a CO₂ leak is minimised.

CO₂ Store & Containment Barriers

- The store has been independently verified as suitable for CO₂ storage by the British Geological Survey.
- It is part of the Captain Sandstone formation, 2,500m below the seabed, and is a natural trap for CO₂.
- It is sealed by impenetrable mudstone rocks, which have trapped and contained hydrocarbons within the site for over 50 million years.
- There are secondary complex seals which provide an additional area of backup containment for the CO₂.
- Previous legacy wells drilled into the site have all been plugged and abandoned to a standard that allows CO₂ storage.
- New CO₂ specific injection wells will be used.
- Planned injection volumes are estimated to be around 28Mt in total over the life of the project.



Below Seabed Rock Stratigraphy of the Acorn South Storage Site & Complex



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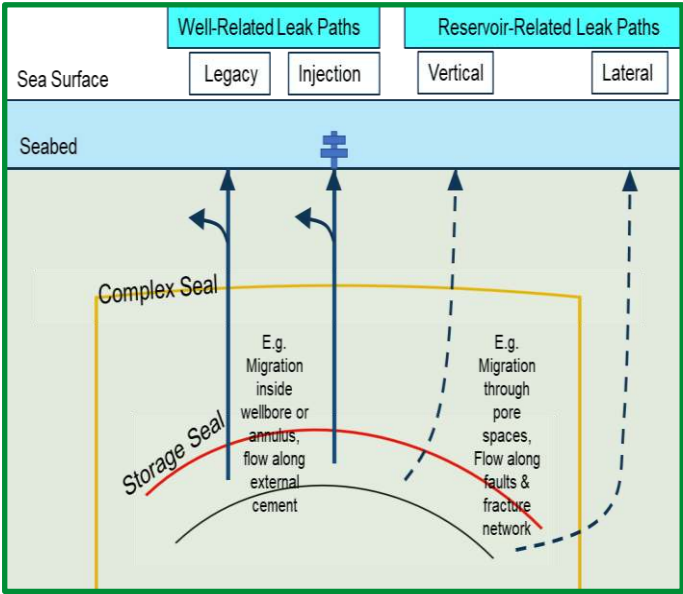


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Safely Delivering Carbon Capture and Storage

Potential CO₂ Leak Pathways & Likelihood

A risk assessment identified and evaluated potential pathways by which CO₂ could leak from the store to the sea surface. The likelihood of such leak pathways was assessed, and a worst-case scenario was considered to understand the volumes of CO₂ which could be released. The assessment concluded the following:



Potential Leak Paths from the Acorn South Storage Site & Complex

- There are no leak pathways which are considered likely or probable. The leak paths with the highest likelihood are ranked highly unlikely.
- Potential leakage from a rupture of the Goldeneye pipeline was assessed to be highly unlikely. As a worse case scenario, 14,752 tonnes of CO₂ would be released.
- The likelihood of a blowout or leakage from the wells during injection of CO₂ was assessed to be highly unlikely. The safety valves would be activated and 0.009 tonnes of CO₂ would be released.
- Potential leakage from injection of CO₂ from the storage site was assessed to be highly unlikely. Any leakage would be unquantifiable and involve a slow release of CO₂.

Likelihood	Leak Path	Likelihood	Leak Path
Likely / continuous	None identified	Remote – barely credible	Flow from Captain up legacy wells 14/29a-27
Probable	None identified		Vertical flow through caprock
Physically possible	None identified		Lateral migration out of complex eastwards
Unlikely	None identified		Lateral migration out of complex northwards
Highly unlikely	Flow up injection well (during injection)	Physically not possible	Lateral migration out of complex southwards
	Flow from all Captain up legacy wells		Vertical migration via faults/fracture networks
	Flow from Captain up injection well (post injection, abandoned)		Flow up all other legacy wells.
	Lateral migration out of storage site		Vertical migration via faults/fracture networks (post injection)

Monitoring Strategy

A detailed strategy has been developed to monitor the storage site, the surrounding seabed, wells and Goldeneye pipeline, so that any accidental release of CO₂ can be identified and remediated.

Surveys will be conducted at the beginning of the construction phase to model the geological store and the marine environment before the injection of CO₂ into the store. This data will be used as a baseline for comparing any potential changes as CO₂ is injected into the store. Monitoring will include:

- 4-D seismic surveying of the CO₂ in the store;
- The use of remotely operated vehicles and downhole and well pressure gauges to monitor the potential leakage of CO₂ from the wells; and
- The use of remotely operated vehicles, flow meters and pressure gauges to identify any potential pipeline rupture.

Long term monitoring will be undertaken after CO₂ has been injected into the store.



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Summary of Offshore Impacts

Not significant impact	Not significant to minor impact	Minor to moderate impact
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Topic	Impact Source	Residual Significance of Effect
<i>Planned Activities</i>		
Physical Presence	Physical disturbance impacts on other vessels (general navigation and fishing) for all Project elements	Not significant
	Physical disturbance impacts on marine mammals and seabirds for all Project elements	Not significant
Seabed Disturbance	Seabed disturbance impacts (primarily on benthic communities) for all Project elements	Not significant to minor
Discharges to Sea	Water quality impacts from discharges to sea and their effects on marine ecology for all Project elements	Not significant
Emissions to Air	Impact on air quality from emissions to air for all Project elements	Not significant
Underwater Noise	Effects of noise on marine mammals from general vessels, cable installation and drilling	Not significant
	Effects of noise on marine mammals from manifold installation (piling)	Moderate
	Effects of noise on fish from manifold installation (piling)	Not significant
	Effects of noise on marine mammals from seismic survey	Moderate
	Effects of noise on fish from seismic survey	Not significant
Waste Generation	Impacts from the generation and management of wastes from all project elements	Not significant
<i>Accidental Events</i>		
Hydrocarbon Release	Impacts from a major blow out of condensate or major spill of diesel fuel on seabirds or marine mammals	Minor to Moderate
	Impacts from a major blow out of condensate or major spill of diesel fuel on fish and fisheries	Not significant to minor
	Impacts from a major blow out of condensate or major spill of diesel fuel on plankton, benthos and other commercial interests	Not significant
Accidental CO ₂ Release	Impacts from an accidental release of CO ₂ from a pipeline rupture or CO ₂ injection well blow out on benthos	Minor at most
	Impacts from an accidental release of CO ₂ from a pipeline rupture or CO ₂ injection well blow out on fish and marine mammals	Not significant
	Impacts from an accidental release of CO ₂ from a leakage from the reservoir via geological structures, abandoned wells or the injection well on all receptors	Not significant

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Assessment of Offshore Impacts

Of all the potential impacts on the environment that were assessed, the majority were found not to be significant. The impacts that were assessed as minor to moderate are detailed further in this board and the following board.

Seabed Disturbance

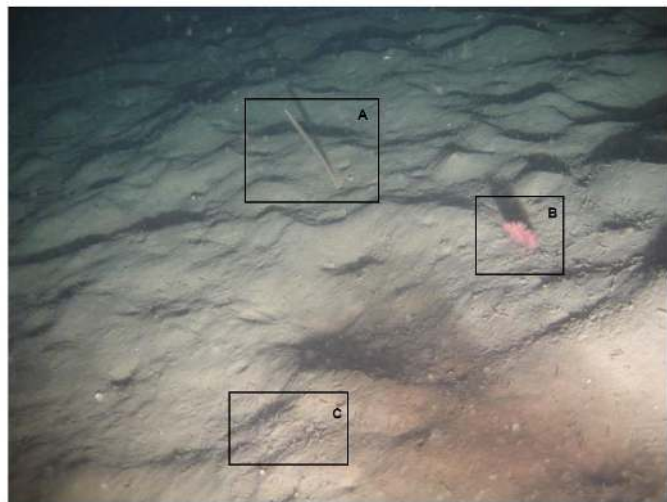
Overview

Seabed disturbance of the sediments and benthic fauna will mainly occur along the route of the 43km umbilical, which will be trenched and buried beneath the seabed for the majority of its length. There will also be impact to the seabed from drill rig anchors and the placement of subsea equipment on the seabed for the life of the project.

The Project is predicted to impact a total seabed area of 0.98 km²; 0.97km² of which is temporary and 0.01km² of which is a longer-term impact.

Impacts

The benthic species (i.e. species that live on the sea floor) found at the site are widespread across the Central North Sea and are dominated by short lived species with high reproduction rates. Impacts are therefore expected to be very localised and temporary, with the recovery of species populations occurring within 1 to 5 years.



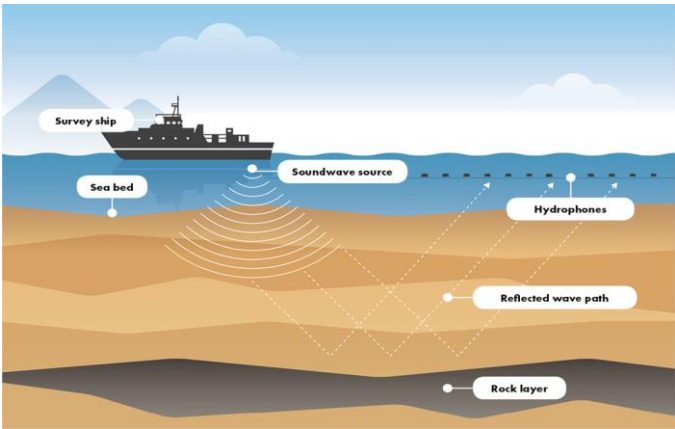
Seabed photo from the storage site showing (a) sea pen (*Virgularia mirabilis*), (b) sea pen (*Pennatula phosphorea*) and (c) polychaeta tubes (Fugro 2009)

Protected benthic habitats, burrowed muds and sea pens, and burrowing megafauna have been identified in the area. However, impact on benthic fauna from the project is assessed to be small given their low to moderate sensitivity to seabed disturbance and ubiquity within the wider area.

Underwater Noise

Overview

Construction and operation of the Project will unavoidably generate underwater sound. This will include relatively low levels from the movement of vessels and drilling, as well as the installation of the umbilical. The highest levels will be generated by the piling of the manifold and during 4-D seismic data gathering in the monitoring phase of the operational CO₂ store.



Sound waves generated by seismic surveys

Both piling and seismic surveys are of a short duration. This duration is estimated to be 16 hours for piling and 10 days per survey, with three surveys planned over the life of the Project.

Impacts

Underwater noise modelling concluded that a small number of sensitive species, including minke whale, white beaked dolphin, Atlantic white sided dolphin and harbour porpoise, may be impacted if they are within proximity to the noise source.

To avoid, reduce and mitigate against such impacts occurring, marine mammal observation and monitoring, as well as soft start and suspension procedures, will be undertaken. Noisy activities will also be scheduled to avoid particularly sensitive times of the year, as identified by the Joint Nature Conservation Committee (JNCC), where practicable.

As a result of following industry guidelines and the low numbers of marine mammals present in the area, it is expected that only a very small number of individual marine mammals may be impacted by the piling and seismic surveys.



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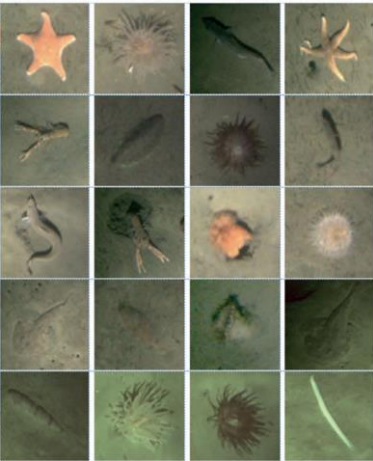
Assessment of Offshore Impacts

Accidental CO₂ Release

Overview

As explained in the ‘Safely Delivering Carbon Capture and Storage’ section, the likelihood of an accidental release of CO₂ has been assessed to be extremely low.

In the unlikely event of a leak, CO₂ would rapidly dissolve in the seawater. As it dissolves, CO₂ would increase the acidity of the surrounding waters and impact organisms living on the seabed in the immediate vicinity of the leak. These organisms, known as benthic fauna are, however, relatively sparsely distributed at the site and many of the species present are tolerant of localised changes in CO₂ concentrations.



Examples of benthic megafauna from the storage site area (STEMM-CCS 2020)

Due to the localised nature of the potentially affected area and the mobile nature of fish species, fish are unlikely to be significantly affected by temporary increases in CO₂ concentration. Marine mammals are also unlikely to be significantly affected by temporary increases in CO₂ levels. Secondary effects may occur due to disruption of their food chains but this is considered very unlikely.

In the event of a pipeline rupture, it is possible that a small proportion of CO₂ may reach the atmosphere, in the shallower water near the shore. This CO₂ would rapidly disperse and the concentration of CO₂ would be too low to impact seabirds, marine mammals or any humans in the vicinity.

Accidental Hydrocarbon Release

Well Integrity

The Acorn South storage site is a depleted hydrocarbon reservoir, where water from the surrounding aquifer has backfilled the space left behind by the hydrocarbons.

There is a very small chance (<1%) of some residual gas remaining within the storage reservoir in isolated pockets, although the volume would be small and it would likely have a negligible impact on well control.

When drilling the CO₂ injection well, there is therefore a very small chance of a well blowout of gas condensate.

- Oil spill modelling concluded that:
- The condensate would evaporate or biodegrade rapidly, with no significant mass of condensate on the sea surface after 120 days
 - No hydrocarbons would reach shore
 - Temporary impacts of minor to moderate significance on seabirds and marine mammals
 - No impacts on the qualifying interests of any marine or coastal designated or protected sites.



Guillemots (wildlife trust.org)

Drill Rig Diesel Spill

The drilling rig will have a maximum of 869 tonnes of marine diesel on-board at any one time. The likelihood of an incident which results in the loss of the entire volume of diesel to sea, is extremely unlikely. The outcome of the oil spill modelling concluded that:

- Any diesel spilt would evaporate or biodegrade rapidly;
- The probability of diesel reaching the shore is less than 1% and limited to a rainbow sheen;
- As diesel evaporates relatively rapidly, the concentrations on the surface and in the water will decrease with distance from the spill location, and continue to reduce over time;
- No impacts on the qualifying interests of any marine or coastal designated or protected sites;
- The significance of potential impacts on seabirds in the event of a spill are considered to be minor offshore and minor in coastal waters (higher sensitivity but low magnitude of impacts); and
- Impacts of minor to moderate significance have been identified for marine mammals.



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Next Steps for Acorn CCS

What happens next?

We welcome your feedback. We will use this feedback to inform the ongoing assessment of the Project. Please fill in the feedback form available at the desk or alternatively online at www.theacornproject.uk

We will continue to engage the Project’s stakeholders to finalise the assessment of environmental impacts. Further public consultation will be undertaken later this year, before the application for onshore consent is submitted. Formal consultation by the regulators will also be undertaken after both the onshore and offshore applications are submitted.

Onshore Planning Application

The assessment will be updated and a further public consultation will be held later in 2021. We will then submit the planning application to Aberdeenshire Council who will make all the application documents publicly available. Comments and letters of support or objections can be submitted to the Council at this time.

Offshore Carbon Storage Permit

The assessment will be updated and submitted to OPRED, who will run the post submission public consultation. Details and access to the final Environmental Statement will be made available on the Acorn and BEIS websites and advertised in national and local papers. Comments, letters of support, or objections can be submitted to OPRED at this time.



Get in touch

If you would like more information or would like to get in touch with us about any wider issues, please contact us at:

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