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Executive Summary

The lack of appraisal of CO₂ storage sites is considered a key hurdle to progressing CCS in the UK.

This project will screen, select and progress appraisal of 5 CO₂ stores applying international best practice.

Screening will use CO₂Stored and public domain sources.

Selection and Appraisal will use the PGS Megamerge seismic data plus seismic and well data from CDA, augmented as necessary.

This Energy Technologies Institute (ETI) Strategic UK CCS Storage Appraisal project has been commissioned on behalf of the Department of Energy and Climate Change. The project brings together existing storage appraisal initiatives, accelerates the development of strategically important storage capacity and leverages further investment in the building this capacity to meet UK needs.

The primary objective is to down-select and materially progress the appraisal of five potential CO₂ storage sites on their path towards final investment decision (FID) readiness from an initial site inventory of over 500. The desired outcome is the delivery of a mature set of high quality CO₂ storage options for the developers of major power and industrial CCS project developers to access in the future. The work will add significantly to the de-risking of these stores and be transferable to storage developers to complete the more capital intensive parts of storage development.

This is the report for Work Package 2 of the project, it identifies information requirements, sources and collation of data for the screening, selection and appraisal phases of the project.

A key challenge has been to identify the data required for the study so that it can be procured in a timely manner before a knowledge of the down-selected sites is available. This makes specific procurement of data within the time available

very challenging. To resolve this an approach of regional data access has been adopted where possible and cost effective.

Information and data required for WP3 will be drawn from public domain, regional databases and in particular CO2Stored.

Well and seismic data will be used in WP4 to develop a due diligence review for the 20 sites. This will require access to seismic (preferably 3D) and well data from across the UKCS. The time constraints of the project mean that this data must be procured ahead of time.

It is recommended that the PGS Megamerge survey for the UKCS (east of Shetland) is procured. This includes seismic data, together with interpreted key horizons allowing rapid review of key features such as faults to surface and interval continuity. The business case and full justification for the 3D seismic procurement are outlined in this report.

For well data and other seismic data it is recommended that a CDA membership is acquired together with a single year subscription to download well and seismic data. CDA is a significant and vitally important component of the private/public partnership that constitutes the NDR (National Data Repository) for the UKCS.

In addition to the data noted above, the WP5 will also benefit from specific data release from current oil and gas operators. Engagement on this will be initiated early through stakeholder workshops and worked on a case by case basis once the five preferred target sites have been identified and approved.

1.0 Objectives

There are three key objectives of this work package:

1. To secure data access to the wide variety of data required to execute the full project screening and detailed appraisal in WP3, WP4 and WP5.
2. To ensure that the IP associated with components of procured data is clear, understood and fully complied with.
3. To provide a business case justification and recommendation for specific data procurement.

Further details regarding IP management are provided in Section 7.0 of this report. This is an important aspect of WP2 because it is the intention that the results of the project will be made available to stakeholders under license from ETI.

Work Package 2 has been divided into the following 6 tasks.

WP2.T1 - Finalise Data Sources for Screening

This will focus on the deployment of CO2Stored. A key source of data will be experience from previous projects. Before the screening starts the results of previous relevant projects that are publically available will be reviewed. Such sources might include the knowledge transfer materials from previous DECC demonstration projects, JIP reports, or published information. The primary purpose of these reports is to inform the selection process on specific stores and methodologies.

WP2.T2 - Define Data Sources for Selection

The data used during the Selection phase will comprise those data sources from

WP2.T1 augmented with specific well data obtained from CDA and, where available, representative seismic lines from the PGS Megamerge through key areas to validate structure and stratigraphic continuity / compartmentalisation. The potential role of data from petroleum operators will be highlighted at stakeholder workshops and early engagement on access to such data started with selected operators.

WP2.T3 - Define Data Sources for Appraisal

The data used during the Appraisal phase will comprise data from WP2.T1 & T2. These data may be supplemented with operator information such as other seismic data for specific locations, where appropriate.

WP2.T4 - Make Recommendation for Data Purchase

A recommendation will be compiled based upon cost-benefit analysis of having more complete and full access to seismic data for WP3, 4 and 5 against the increased overall cost. The overall value proposition is expected to be the delivery of a more robust evidence based down select process.

WP2.T5 - Clarify Early Access to East Irish Sea Seismic Data

This step will pave the way for access to seismic data access for key strategic storage sites in the East Irish Sea should data from such stores be required as part of WP5.

WP2.T6 - Write Final Report

This will comprise the WP2 Report (D02).

2.0 Basis of Design

An outline basis of design for the project is presented in WP1 report.

The outline basis of design and the study methodology has a direct bearing upon the data requirements and when the data is required. As an illustration of this interaction, a decision has been taken to ensure that potential sites have a minimum amount of data coverage that is also available to the Project in the right timeframe. This data coverage is such that a subsurface characterisation suitable for an outline storage development plan can be implemented. To this end the outline basis of design specifies that for a site to be considered as eligible it must have modern 3D seismic coverage and also data from at least relevant one well penetration available.

Any sites without this basic level of data coverage will not be capable of material progression in their appraisal status and so are unlikely to fulfil the project objectives at this stage. This does not necessarily mean that there is no CO₂ storage potential at that site, but simply that further investment in exploration (seismic and/or wells) will be required before the site can be materially progressed.

3.0 Data Sources for Screening

The screening stage is focused on Work Package 3 (WP3). At this stage the following data sources will be primary requirements of the project.

Third Party Source	Nature of the IP	Use in the Project & Status
Wood Mackenzie	Cessation of Production data	WP3, 4, 5. Site selection and maturing. Assessment of timing & availability of depleted hydrocarbon fields.
BGS Crown Estate	CO2Stored	All work packages Already in place.
Demo 1 KT (DECC via National Archives)	Kingsnorth FEED Longannet FEED	All work packages Material publically available via the National Archives.
CO2DeepStore	Screening Study of Southern North Sea Captain Aquifer conceptual development material East Irish Sea (Hamilton) Conceptual development material	WP3, 4, 5. Site selection and maturing
Public data	Millennium Atlas DECC website Published papers North Sea 25th Anniversary Volume	All work packages Published production and injection records for UK oil and gas fields.

Table 1: Data Sources for Screening

WP3 will focus on the deployment of the CO2Stored database. This contains screening level data from over 500 potential storage sites collected and assembled on a consistent basis by the British Geological Survey and the UK Storage Appraisal project⁴. This current project will rely largely upon this data to screen down candidate stores from over 500 potential sites to 20.

A key source of data will be experience from previous projects. Before the screening starts the results of previous relevant projects that are publically available will be reviewed. Such sources include the knowledge transfer materials from previous DECC demonstration projects⁹, JIP reports, and published information such as best practice guidelines^{7,8}. The primary purpose of these reports would be to inform the selection process both on specific stores and methodologies.

4.0 Data Sources for Selection

The selection stage is focused on Work Package 4 (WP4). At this stage the following data sources will be primary requirements of the project, in addition to those used for WP3.

Third Party Source	Nature of the IP	Use in the Project & Status
PGS	Multiclient Seismic data	WP 4, 5. Site selection and maturing. Development of reservoir and overburden characterisation including geological horizons.
CDA	UKCS released well data	WP 4, 5. Site selection and maturing. Development of reservoir and overburden characterisation including geological horizon. Development of existing well leakage risk analysis. Development of new well design.
CDA	UKCS released seismic data	WP 4, 5. Site selection and maturing. Development of reservoir and overburden characterisation including geological horizon.
Petroleum Licensees	Proprietary site specific O&G data	WP 4,5 Site selection and maturing. Specific Petroleum Licensees to be identified after selection of 5 stores.
Centrica	Morecambe field CCS study	WP 4,5 Initial discussion underway.
Centrica	East Irish Sea Seismic data	WP 4,5 Initial discussion underway.

Table 2: Data Sources for Selection

The Selection work to be completed in WP4 will involve the interrogation of site specific data from twenty storage sites which have been down-selected in WP3. Whilst no new interpretation work will be completed at this stage, the data will be used to ensure that there is clear evidence to support the position of each site within the inventory of the top twenty candidate storage sites.

Primary data sources at this time will be the 3D data from the PGS Megamerge survey which will enable example seismic lines to be reviewed quickly over each site to validate structure and stratigraphic continuity / compartmentalisation. The CDA data store will be used to access a representative well log from each site also to ensure that the reservoir and overburden are appropriately characterised at this important due diligence stage.

The potential role of petroleum operator data supply will be highlighted at stakeholder workshops. Early engagement on such data access options has started and will continue through dialogue with selected operators. The Oil and Gas Authority maintain a detailed database of the all the companies that have an interest in Petroleum Licences. The Operator is clearly identified and is normally the company that has acquired the data. Once the 5 selected sites have been identified, the Operator of any relevant Petroleum Licence will be known and it will be possible to approach them with a specific data request. Arrangements have been put in place so that that operator data accessed through an NDA can benefit the project without full disclosure - see Section 7.0 regarding IP Management.

5.0 Data Sources for Appraisal

The appraisal stage is focused on Work Package 5 (WP5). At this stage the following data sources will be considered for the project in addition to those used for WP3 and WP4.

Third Party Source	Nature of the IP	Use in the Project & Status
IHS	Processed well log data	<p>WP5 Site Appraisal</p> <p>Development of reservoir and overburden characterisation including geological horizon.</p> <p>The potential use of processed log data for wells in target sites could reduce the cost of Petrophysical support. Any subsequent decision to use IHS data will be taken on the basis of a net cost benefit to the project.</p>
Petroleum Licensees	Proprietary site specific O&G data such as production/injection rates, pressures, volumes and reservoir surveillance reports	<p>WP4, 5 Site selection and maturing.</p> <p>Specific Petroleum Licensees to be identified after selection of 5 stores.</p>

Table 3: Data Sources for Appraisal

The primary data sources for WP5 will comprise the PGS Megamerge 3D and also log data from CDA. Where required this will be supplemented by seismic data from CDA to ensure good coverage of target sites.

Commercial sources of log data are also highlighted here as they can potentially be useful for target sites that are depleted oil and gas fields where there is a considerable amount of well data. In this situation it may be more cost effective for the project to source commercial ready processed well log data rather than spend a considerable amount of petrophysics analysis time delivering the same material. This decision will be made on a case by case basis and the costs drawn from the petrophysical analysis budget.

A key aspect at this stage for data rich sites will be ready access to operator well records and well histories including dynamic pressure, flow information and special core analysis. This data may not always be available within the CDA and so the petroleum operator is a potential source of important data. Of particular note are some inputs to dynamic flow modelling and integrity considerations such as CO₂/Brine relative permeability of reservoir formations and also mercury injection capillary pressure data from caprock formations. The availability of specific CO₂/Brine relative permeability for formations in the UK is extremely scarce since it is not required for conventional oil and gas work. In the event that specific data cannot be accessed then a combination of analogue data from another geography coupled with appropriate sensitivity analysis will be deployed in its place.

The potential role of petroleum operator data supply will be highlighted at stakeholder workshops. Early engagement on such data access options has started and will continue through dialogue with selected operators. Arrangements have been put in place such that that operator data accessed through an NDA can benefit the project without full disclosure - see Section 7.0 regarding IP Management.

East Irish Sea data

It should be noted that the PGS Megamerge 3D does not extend to the East Irish Sea. The emissions in the NW of England and the use of the East Irish Sea as a location for CO₂ storage sites has been fully envisaged by several parties including the ETI in their Balanced CCS Build Out scenario⁶. It is possible that one of the final five sites may be located in the East Irish Sea. In this situation the following options are available:-

1. Seek a commercial arrangement with the major operator in the area to access their proprietary 3D seismic data.
2. Draw from seismic data available in CDA.

Initial quotes from the key operator suggest that even a discounted access fee for this data would require almost 50% of the full project seismic data budget for 20% of the appraisal site count. Consequently, data will be drawn from CDA where possible and where this is not possible some sites may not make the eligibility check on the basis of data availability and would be down selected (See WP1 report).

Additionally, Centrica have indicated that they may be willing to share the results of their own CO₂ storage study with the project. These options will be progressed wherever possible and where they make a valuable contribution to the project.

6.0 Recommendations on Data Procurement

The following recommendations are presented for data procurement.

1. Establish a full CDA membership along with a license to download well data and seismic data.
2. Acquire a full listing of current cessation of production dates for all UKCS oil and gas fields developed on a consistent basis together with an associated estimated ultimate recovery from Wood Mackenzie.
3. Procure the PGS UKCS Megamerge 3D for all areas excluding the West of Shetland.

Business Case for the procurement of the PGS Megamerge 3D Data

Modern 3D seismic data is now a pre-requisite for the appraisal of CO₂ Storage sites, enabling:

- Detailed structural imaging.
- Location, orientation and throw of geological faults.
- 3D time and depth formation horizon maps.
- Large-scale vertical and horizontal reservoir stratigraphic features, particularly unconformities, erosional surfaces and heterogeneity.
- Detailed, local map of lateral continuity of the primary seal.

Whilst not specifically a mandated requirement in best practice^{7,8} or with the CCS Directive¹⁰, it is considered highly unlikely that the UK regulator would consider a proposed storage development plan without 3D seismic data coverage of an offshore storage site. Furthermore, such 3D coverage would be important to build confidence in the storage appraisal work.

Whilst it is entirely possible to negotiate and trade access to proprietary seismic data through petroleum operators, the dynamics and time constraints of this project, coupled with the need to access seismic data over twenty separate target storage sites make that approach unfeasible. Once the site inventory has been down-selected from over 500 sites to 20 sites at the end of WP3, seismic data access will be required for each site to verify the structural configuration, and complexity of the storage reservoir and its overburden formations. This is essential so that should a site have a critical area of concern, such as a fault which cuts from the target storage reservoir through the overburden almost to the surface, then these very high risk sites can be eliminated from consideration at an early stage. It is therefore important that seismic data can be accessed at WP4 stage for each storage site in the inventory.

The outline basis of design has specified a minimum practical capacity for each site of 75MT. Some sites will need to be much larger than this if the portfolio is to meet the stated project objectives. Given that the seismic data must cover a broader storage complex and not just the storage site itself this means that the seismic data requirement for each site is likely to be around 600 km² (for a depleted gas field) and potentially much more for a saline aquifer. With twenty sites to consider, this represents a cost of \$600,000 at \$50/km². Furthermore this site by site procurement could only be made once the 20 down selected sites had been identified and if any of these sites were eliminated for other reasons further procurement would be required.

The PGS Megamerge 3D would provide extensive and consistent 3D coverage over 79,000 km² in a patchwork across the North Sea area. It excludes data in the English Channel or West of Britain. This survey is available for significantly

less than the site by site approach and can be procured in a single step ahead of WP4 so that it is ready to deploy.

The license price includes delivery of:

- One copy of the final full-offset stack data in SEG-Y at 12.5m x 12.5m trace spacing.
- One copy of the final full-offset stack data in a workstation format (Kingdom/Petrel) at 50m x 50m trace spacing with the interpretation package.

Procuring the PGS Megamerge 3D seismic survey package (excluding West of Shetland) is the least cost, most effective and project efficient means of access to seismic data and will support the timely delivery of project objectives. The costs have been factored into the project budget.

Finally, it is important to verify that the PGS Megamerge seismic coverage is geographically well located to be useful for characterization of potential CO₂ storage sites. A comparison of the maps shown in Figure 1 and Figure 2 clearly illustrates the strong correlation between the foot-print of the PGS Megamerge data on the left with the identified full inventory of storage sites in the North Sea from CO₂Stored on the right.

The PGS Megamerge dataset is therefore the strongest candidate for seismic data access for this study. It comprises a carefully merged patchwork of different surveys from different operators and vintages. As such coverage is not continuous and there are some areas which do not have 3D extent as illustrated in Figure 1. Of particular relevance to this project Bunter closures 1, 7, 29, 35 and 40 are only partially covered. To ensure that the impact of these low or partial coverage areas are minimised, seismic data (often of an older vintage

and often 2D) will also be available from CDA to serve as infill where required and available.

The survey also comes complete with a full horizon interpretation package which will enable much faster access to the key issues associated with each storage site.

The following horizons are already available and will be used to aid the interpretation phase.

- Seabed
- Base Pliocene Unconformity
- Top Intra Eocene Fans (localized interpretation)
- Base Intra Eocene Fans (localized interpretation)
- Top Balder Formation
- Base Tertiary Unconformity
- Base Cretaceous Unconformity

Northern and Central North Sea MegaSurvey

- Top Hordaland Group
- Eocene Sand
- Top Sele Formation
- Top Chalk Group
- Top Plenus Marl Formation
- Base Chalk
- Base Cretaceous Unconformity
- Base Zechstein

Southern North Sea Mega Survey

- Top Chalk
- Top Red Chalk
- Base Cretaceous Unconformity
- Top Triassic
- Bunter Sandstone
- Top Zechstein
- Base Zechstein
- Top Carboniferous

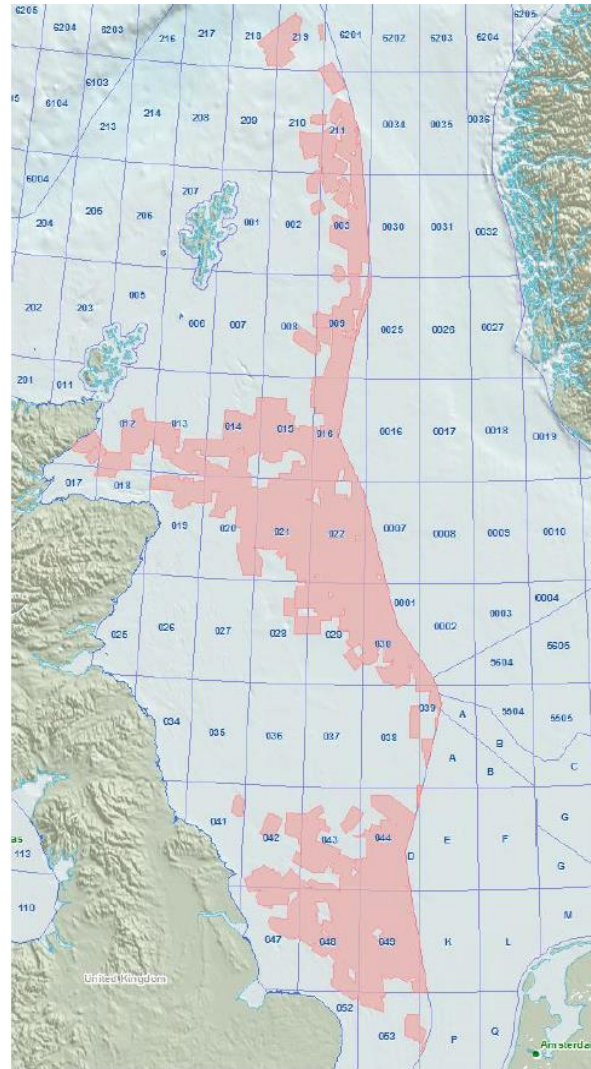
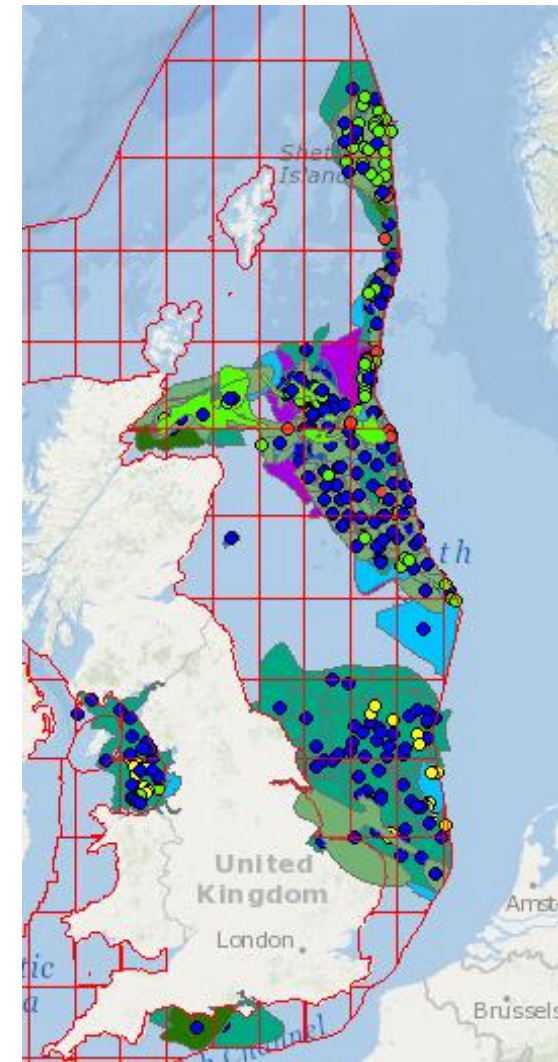


Figure 1: North Sea MegaSurvey (source PGS)

Figure 2: CO₂ Storage Sites (source CO2Stored)

7.0 IP Management

The primary objective of this project involves the delivery of a mature set of high quality CO₂ storage options for the developers of major power and industrial CCS developers to access in the future. The work will add significantly to the de-risking of these stores and be transferable to storage developers to complete the more capital intensive parts of storage development.

It is important therefore that the results of the project can be transferred to future storage developers under license by the ETI but importantly whilst fully honouring all the Intellectual Property (IP) rights of the data owners and providers. It is important therefore that any data, interpretation or model used has a clear IP provenance associated with it so that IP integrity can be maintained throughout.

To facilitate this clarity, each data item will be tagged according to how the IP for the data will be treated and in each case in compliance with the project contract ensured.

The following classes of data IP have been identified:

Class A – Full Disclosure

Participants (and/or sub-contractors) have access to data and the ETI has full rights to use the data in the Project (however included in the deliverables and the results) including full disclosure of the information to the public domain as considered appropriate. Class A includes; interpreted data, images, reservoir model data, reports, conclusions, outline storage development plans, methodologies developed for this project and will comprise either:

- Arising IP.

- ETI IP used in accordance with Schedule 3 of the project contract.
- Background IP licensed by a Participant or Sub-contractor (for example, such as elements of CO₂DeepStore IP made available to the project), or Third Party IP (such as some public domain material) which has in each case been appropriately licensed and consented by the ETI under the relevant sections of Schedules 1 or 2 of this project contract and is credited appropriately in the Deliverables.

Class B – Partial Disclosure under terms

Participants (and/or sub-contractors) have access to data. Such data will not form part of the deliverables/results. The participants (or their sub-contractors) will have limited rights to use the data in the Project or may only use derived data in Deliverables but in any case, if shared with the ETI (and subject to the process for consenting by the ETI under Clause 2.2 (e) of Schedule 1, (a) the ETI may need to agree it will be unable to disclose the information further, including into the public domain) or (b) comprises derived data and the Participants will have provided evidence that such derived data comprises Arising IP or is permitted by the licence with a third party and consented under the process under Clause 2.2 (e) of Schedule 1. E.g. PGS raw seismic data, CDA well data, Petroleum Licensee data provided under confidentiality agreement. Possibly any input from Shell or National Grid Carbon on current commercialisation programme storage sites.

Class C – Inform but no Disclosure

Participants (and/or sub-contractors) have access to data. Data may inform work undertaken by participants (and/or sub-contractors). Data will not form part of

the deliverables/results. ETI will not be provided with or require the data (and therefore rights to use the data). E.g. Petroleum Licensee data provided under confidentiality agreement rather than under licence, material from other non-public projects which the consortium have access to. Possibly any input from Shell or National Grid Carbon on current commercialisation programme storage sites.

Class D – Not Disclosed

Commercially available software used by participants (and/or sub-contractors). Such software will not form part of the deliverables/results but if it is required to use a deliverable (such as a reservoir model) it will be subject to the consent process for Background IP or Third Party IP in Clause 2.2.of Schedule 1.

8.0 Data Summary Table

Table 4 provides a summary of the data sources to be deployed in this project.

Third Party Source	Nature of the IP	Licensed to	Accessed by	Use in the project & status	IP Class (See Section 7.0)
PGS	Multiclient Seismic data	Pale Blue Dot Energy	PBDE, Axis, Schlumberger	WP 4, 5. Site selection and maturing. Development of reservoir and overburden characterisation including geological horizons	B
CDA	UKCS released well data	Pale Blue Dot Energy	PBDE, Axis, SLB	WP 4, 5. Site selection and maturing Development of reservoir and overburden characterisation including geological horizon Development of existing well leakage risk analysis Development of new well design	B
CDA	UKCS released seismic data	Pale Blue Dot Energy	PBDE, Axis	WP 4, 5. Site selection and maturing Development of reservoir and overburden characterisation including geological horizon	B
IHS	Processed well log data	Pale Blue Dot Energy	PBDE, Axis, SLB	WP5 Site Appraisal Development of reservoir and overburden characterisation including geological horizon The potential use of processed log data for wells in target sites could reduce the cost of Petrophysical support. Any subsequent decision to use IHS data will be taken on the basis of a net cost benefit to the project.	B
Wood Mackenzie	Cessation of Production data	Pale Blue Dot Energy	PBDE, Axis, Costain	WP3, 4, 5. Site selection and maturing Assessment of timing & availability of depleted hydrocarbon fields	B
BGS Crown Estate	CO2Stored	Pale Blue Dot Energy, via ETI	PBDE, Axis, Costain	All work packages Already in place	B
Multistore	MultiStore JIP	Pale Blue Dot Energy	PBDE, Axis	WP5 Maturing of selected stores No access available other than public summary when published	A (public summary)
Petroleum Licensees	Proprietary site specific O&G data	Pale Blue Dot Energy	PBDE, Axis, Costain	WP4, 5 Site selection and maturing Specific Petroleum Licensees to be identified after selection of 5 stores	C

Centrica	Morecambe field CCS study	Pale Blue Dot Energy	PBDE, Axis, Costain	WP4, 5 Initial discussion underway	TBA
Centrica	East Irish Sea Seismic data	Pale Blue Dot Energy	PBDE, Axis	WP4, 5 Initial discussion underway	TBA
NGC	Regional & 5/42 Appraisal data	Pale Blue Dot Energy	PBDE, Axis, Costain	WP4, 5 Site selection and maturing for 5/42 area extension. NGC still considering their approach to data release	C
Shell Goldeneye	Appraisal data	Pale Blue Dot Energy	PBDE, Axis, Costain	WP4, 5 Site selection and maturing for Captain aquifer Shell still considering their approach to data release	C
Demo 2 KT (DECC)	Shell and NGC appraisal data	Pale Blue Dot or Public	PBDE, Axis, Costain	WP4, 5 Site selection and maturing Demo 2 KT release to the project requested and under consideration	A
Demo 1 KT (DECC via national archives)	Hewett FEED Longannet FEED	Public	PBDE, Axis, Costain	WP1, 2, 3, 4, 5, 6 Material publically available via the National Archives, used subject to copyright restrictions	A
EON	Hewett reservoir model from Kingsnorth Demo 1	Pale Blue Dot	PBDE, Axis	WP5 Initial discussion underway	TBA
BGS	Core viewing	Public	PBDE, Axis	WP5	A
CO2DeepStore	Hamilton Study Captain Aquifer, SNS Study	Pale Blue Dot	PBDE, Axis	WP3, 4, 5 Site selection and maturing	
Public data	Millennium Atlas DECC website Published papers North Sea 25th Anniversary Volume	Public	PBDE, Axis, Costain	WP1, 2, 3, 4, 5, 6	A

Table 4: Data Sources and Usage

References

1. *Delivering CO₂ storage at the lowest cost in time to support the UK decarbonisation goals*. UK Transport and Storage Development Group, 2013.
<http://www.thecrownestate.co.uk/media/389719/ei-delivering-co2-storage-to-support-decarbonisation-goals-tdsg.pdf>
2. *Next Steps in CCS: Policy Scoping Document*. DECC, 2014.
<https://www.gov.uk/government/publications/ccs-policy-scoping-document>
3. *UK CO₂ Storage Evaluation Database - CO2Stored*. The Crown Estate, 2009.
<http://www.co2stored.co.uk>
4. *UK Storage Appraisal Project: Final Report (UKSAP)*. The Energy Technologies Institute (ETI), 2011.
<http://www.eti.co.uk/project/uk-storage-appraisal-project/>
5. *CO₂ STORAGE Evaluation Database (CO2Stored)*. The UK's online storage atlas. Bentham, M. et. al., 2014.
<http://nora.nerc.ac.uk/509387/1/1-s2.0-S1876610214023558-main.pdf>
6. *CCS Sector Development Scenarios in the UK*. Element Energy & Pöyry, 2015.
<http://www.eti.co.uk/wp-content/uploads/2015/05/2015-04-30-ETI-CCS-sector-development-scenarios-Final-Report.pdf>
7. *DNV-DSS-402 Qualification Management for Geological Storage of CO₂*. DNV, 2012
<http://www2.dnvgl.com/DNV-DSS-402>
8. *DNV-RP-J203 Geological Storage of Carbon Dioxide*. DNV, 2012.
<http://www2.dnvgl.com/DNV-RP-J203>
9. *UKCS Demonstration Competition, Post FEED End to End Basis of Design, Section 6.2*. Shell, 2011
http://webarchive.nationalarchives.gov.uk/20111209170139/https://www.decc.gov.uk/en/content/cms/emissions/ccs/demo_prog/feed/scottish_power/scottish_power.aspx
10. *Directive 2009/31/EC on the Geological Storage of Carbon Dioxide*. European Parliament, 2009
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF>
11. *Assessing European Capacity for Geological Storage of Carbon Dioxide*. Geological Survey of Denmark and Greenland, 2009.
<http://www.geology.cz/geocapacity/publications/D42%20GeoCapacity%20Final%20Report-red.pdf>
12. *Choosing good sites for storing CO₂ underground*. SiteChar, 2014.
<http://www.sitechar-co2.eu/SciPublicationsData.aspx?IdPublication=339&IdType=557>
13. *EU Geocapacity - Assessment of CO₂ Geological Storage Potential of Europe*, Vangkilde-Pedersen, Geus et al, 2011
<http://www.cgseurope.net/UserFiles/file/1st%20Kickoff%20meeting/Presentations/17-Vangkilde-Pedersen.pdf>
14. *Multiple Attribute Decision Making: Methods and Applications*. Hwang and Yoon, 1981.

15. *A comparison of Fuzzy AHP and Fuzzy TOPSIS methods to supplier selection. Applied Soft Computing* 21, 194–209. Lima Junior, F.R., Osiro, L. & Ribiero Carpinetti, L.C., 2014.
16. *TOPSIS in Excel*. Hodgett, R., 2014
<http://hodgett.co.uk/topsis-in-excel/>
17. *Oil and Gas: Licensing for Carbon Storage*. Oil & Gas Authority. 2013.
<https://www.gov.uk/oil-and-gas-licensing-for-carbon-storage--3>
18. *Evidence Support Logic: A Guide for TESLA Users*. Quintessa Limited, 2008.
https://www.quintessa.org/repository/files/Evidence_Support_Logic_Guide_v3.0.pdf
19. *CarbonNet storage site selection & certification: challenges and successes*. Carman, G. & Hoffman, N., 2012.
www.energyandresources.vic.gov.au/carbonnet
20. *A review of best practice manuals for carbon dioxide storage and regulation*. CO2CRC, 2011.
<http://www.globalccsinstitute.com/publications/review-existing-best-practice-manuals-carbon-dioxide-storage-and-regulation>
21. *Millennium Atlas: Petroleum Geology of the Central & Northern North Sea*. Millennium Atlas Company, 2002
<https://www.geolsoc.org.uk/MILCD>
22. *United Kingdom Oil and Gas Fields 25 Years Commemorative Volume*. The Geological Society, 1991
<http://mem.lyellcollection.org/content/14/1/local/front-matter.pdf>