From Acorn to SAPLING - Chain Integration in the UK

David Pilbeam – ACT Knowledge Sharing Workshop

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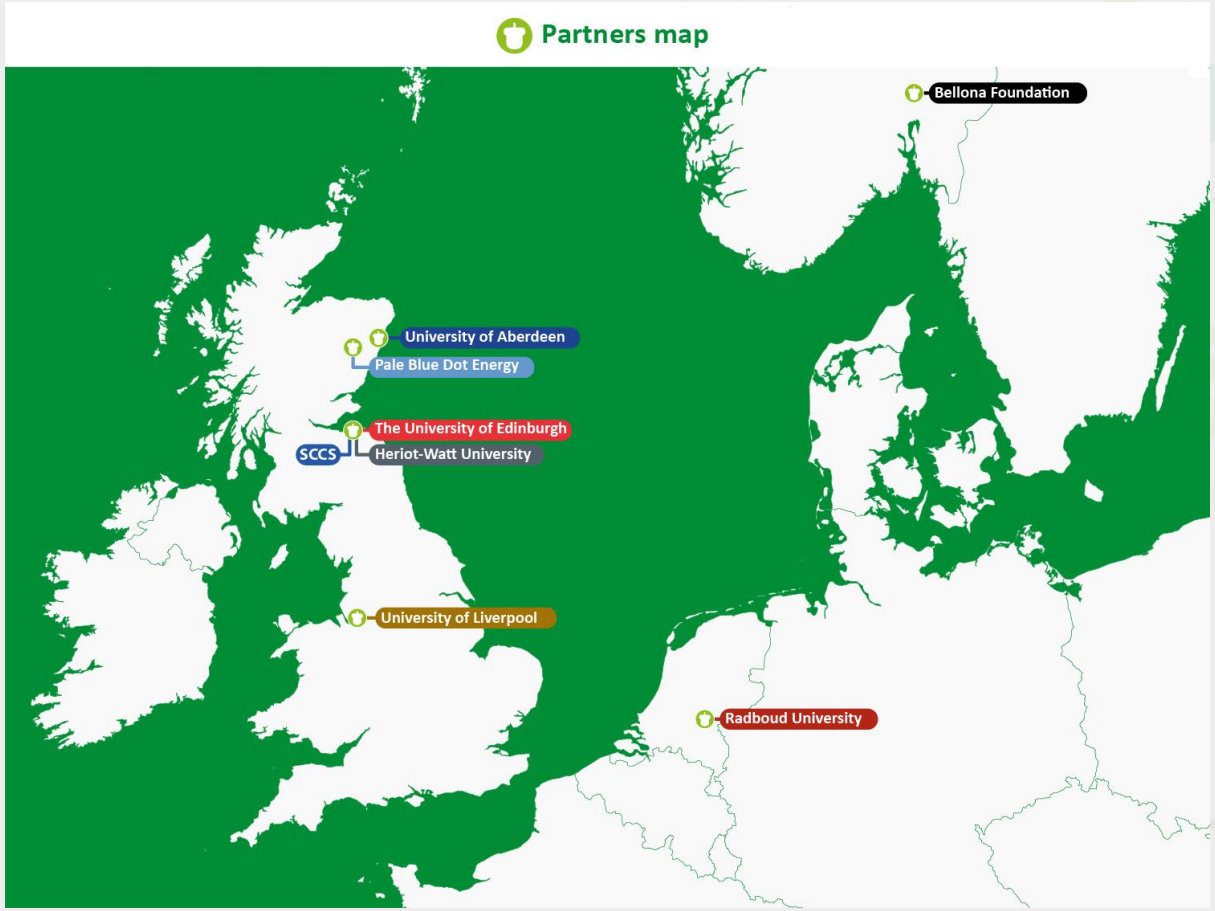
ACT Acorn:

a catalyst for low-cost, low-risk clean growth

The ACT Acorn Consortium is led by Pale Blue Dot Energy and includes The Bellona Foundation, Heriot-Watt University, Radboud University, Scottish Carbon Capture & Storage (SCCS), University of Aberdeen, The University of Edinburgh and University of Liverpool.

The ACT Acorn Partners



Pale Blue Dot.

UNIVERSITY OF ABERDEEN

SCCS

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF LIVERPOOL

HERIOT WATT UNIVERSITY

BELLONA

Radboud University

acorn
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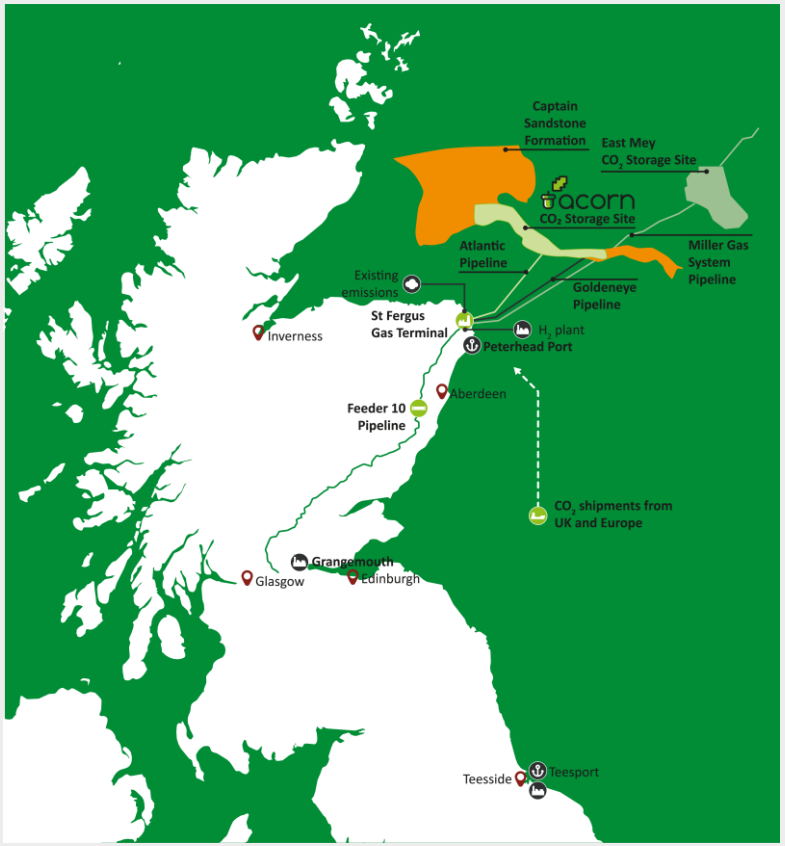
What is Acorn CCS?



a catalyst for low-cost, low-risk clean growth

Acorn CCS starts with a modest 200,000 tonnes of existing CO_2 emissions from St Fergus Gas Terminal

Unlocking a very large CO_2 transportation and storage solution, with lots of exciting options for growth…

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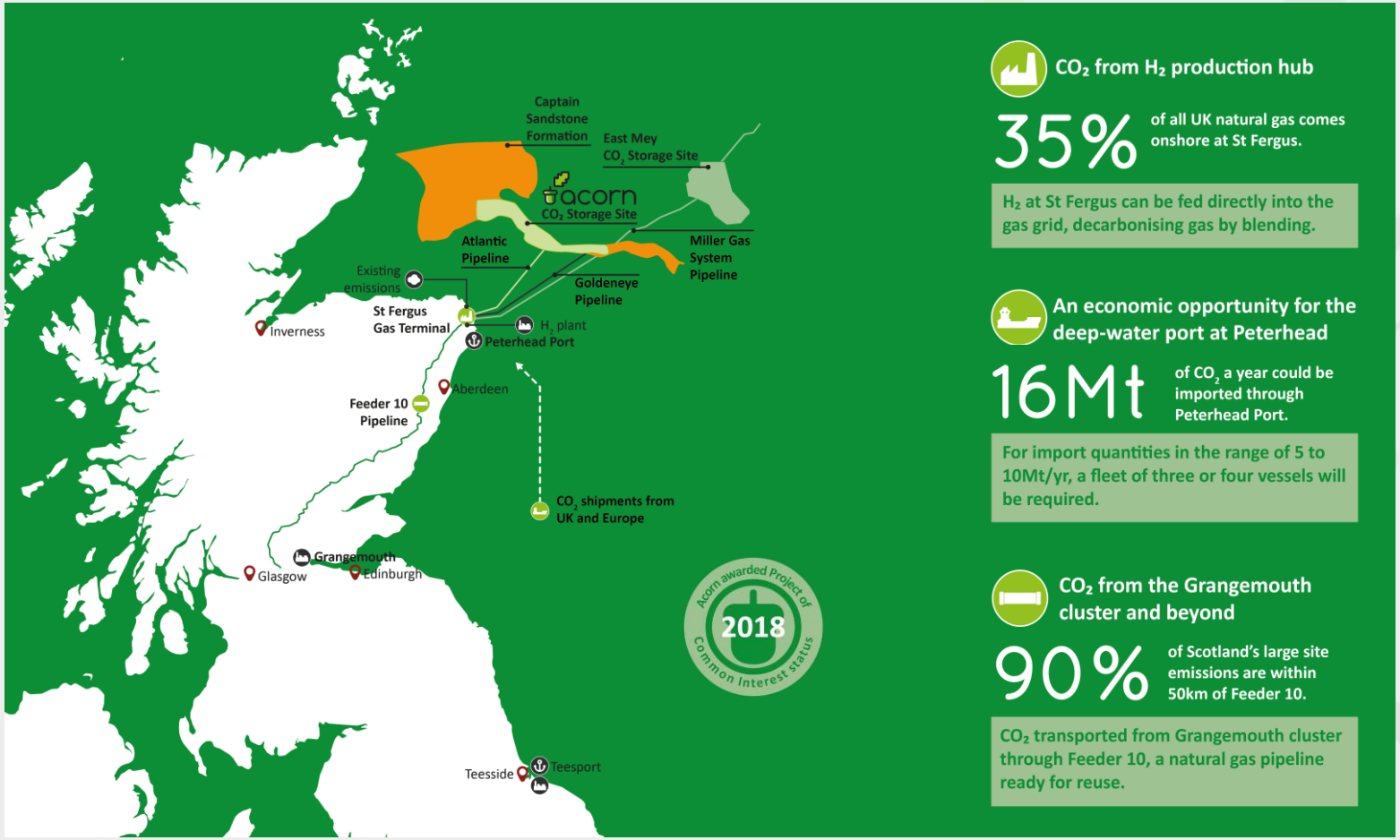
The Acorn Options



CO_2 from H_2 production hub

35% of all UK natural gas comes onshore at St Fergus.

H_2 at St Fergus can be fed directly into the gas grid, decarbonising gas by blending.

An economic opportunity for the deep-water port at Peterhead

16Mt of CO_2 a year could be imported through Peterhead Port.

For import quantities in the range of 5 to 10Mt/yr, a fleet of three or four vessels will be required.

CO_2 from the Grangemouth cluster and beyond

90% of Scotland's large site emissions are within 50km of Feeder 10.

CO_2 transported from Grangemouth cluster through Feeder 10, a natural gas pipeline ready for reuse.

The Acorn Economics

LOW COST
For CCUS, a very low capital investment of just
£276m

EFFICIENT
Phase 1 delivers a minimum
2Mt/yr
transport and storage infrastructure solution.

DELIVERS
With the right support, Acorn can be operating in
2023

Through Acorn, the UK can derive maximum environmental benefits from legacy oil and gas assets, unlocking early CO_2 transportation and storage solutions for other carbon capture, usage and storage (CCUS) clusters.

Life Cycle Assessment

	Reference case	Conservative build-out case	Optimistic build-out case
Carbon footprint	Greenhouse gas emissions reduced by 3Mt (↓50%) between 2022-2036	Greenhouse gas emissions reduced by 268Mt (↓69%) between 2022-2089	Greenhouse gas emissions reduced from 470Mt (↓68%) between 2022-2089
Impact on health	↓ 25%	↓ 52%	↓ 54%
Impact on ecosystems	↓ 35%	↓ 54%	↓ 56%
Impact on resource scarcity	↑ £19 per tonne of CO_2 captured and stored	↑ £21 per tonne of CO_2 captured and stored	↑ £21 per tonne of CO_2 captured and stored

Life Cycle Assessment Key Findings

Areas for improvement

- Capture process innovation
- Minimising heat requirements through engineering optimisation
- Capturing emissions associated with heat requirement

Acorn CCS life cycle assessment

- Acorn CCS leads to major reductions in carbon footprint at all scales and in all scenarios, and consequently leads to lower predicted impacts on human health and ecosystems

CCS and a Just Transtition

What role, if any, do **stakeholders and citizens** think carbon capture and storage **(CCS)** has in helping to achieve a more **environmentally sustainable future** in regions whose workers and economies rely on **carbon intensive industries?**

North East Scotland findings

Benefits and public interest
Questions around who benefits from CCS and how to manage CCS developments in the public interest.

Respect for workers
Strong sense of identity and history comes from the oil and gas industries that needs to be valued.

Infrastructure reuse
Infrastructure reuse can help transform an area, stakeholders instantly make connections with decommissioning.

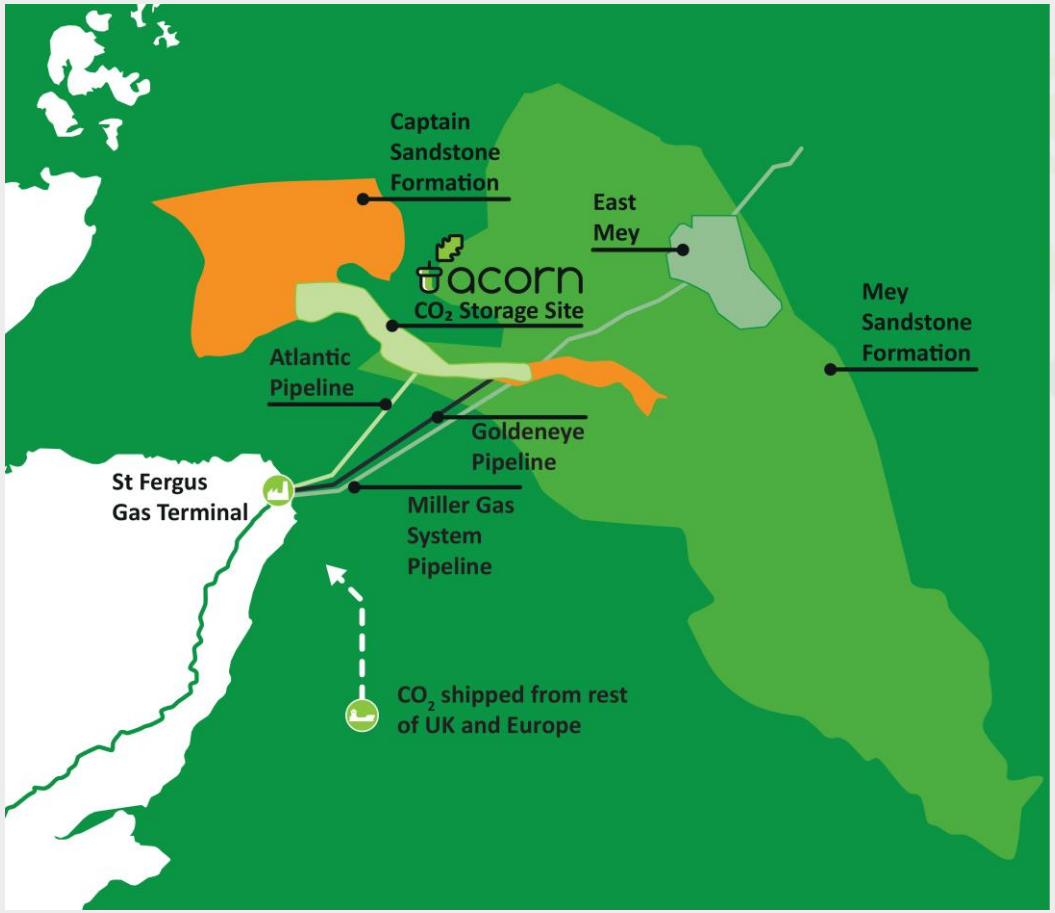
Wider implications for other regions

Role for local government
Expectation that city/regional governments should take the lead in setting out local pathways for a just transition.

Lack of understanding
In carbon-intensive regions with limited connection to subsurface oil and gas activities, understanding of the role of CCS in a just transition is less apparent.

Site-specific infrastructure
Although CCS is a very flexible technology, there were strong feelings in the Netherlands that the equipment is highly site-specific and will not help establish a just transition in every carbon-intensive region.

Unlocking Underground CO_2 Storage



The Acorn CO_2 Storage Site preselected from a previous site screening process with the Energy Technologies Institute:
www.eti.co.uk/programmes/carbon-capture-storage/strategic-uk-ccs-storage-appraisal

Key findings

- Both storage sites are highly suitable for the injection and long-term storage of CO_2.
- Both the Captain and Mey Sandstones are highly porous and permeable, with rock chemistry that is stable in CO_2-rich conditions.
- The Mey Sandstone has a greater rock strength than the Captain Sandstone due to its lower overall porosity.
- All the samples tested are strong enough to withstand expected pressures/stresses during CO_2 injection operations and long-term storage.

What next for Acorn?

Acorn Project Status

acorn Hydrogen

acorn

Oil & Gas Authority

First OGA CO_2 Storage Licence

Connecting Europe Facility

First CCS project to be awarded PCI funding

CHRYSAOR

TOTAL

Pale Blue Dot.

European Commission

Department for Business, Energy & Industrial Strategy

The Scottish Government
Riaghaltas na h-Alba

Acorn Project Timeline

Today…

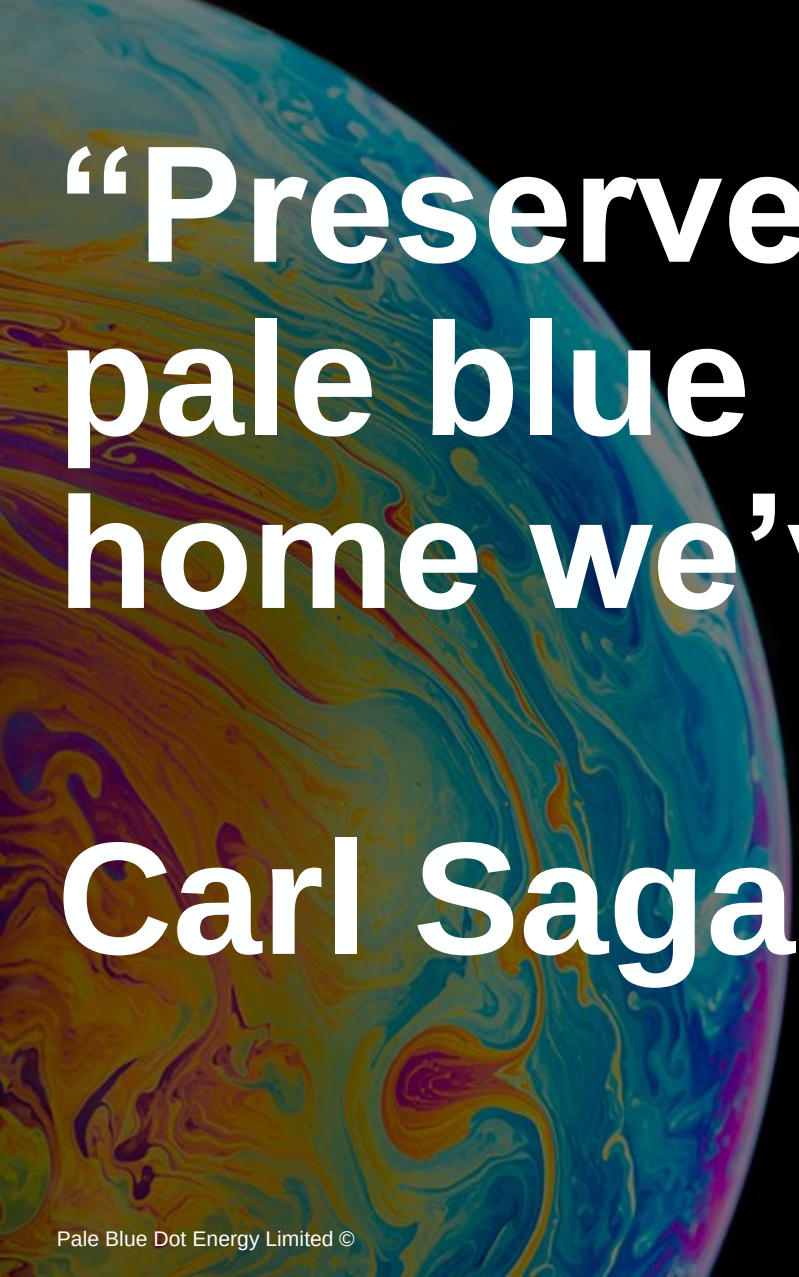
- Detailed design studies for Acorn CCS
- Hydrogen Supply competition bid for Acorn Hydrogen

Early 2020's…

- Financial Investment Decision (FID) 2021
- Acorn CCS construction
- Acorn CCS on line 2024

Mid 2020's…

- Acorn Hydrogen 2025
- Acorn CCS build out opportunities
- Acorn Hydrogen growth



“Preserve and cherish the pale blue dot, the only home we’ve ever known.”

Carl Sagan

Pale Blue Dot.

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