

2011 Strategy for CATs RD&D

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Introduction

- Why an update of the 2009 strategy?
- Is the UK still amongst the leading countries?

Aim and Vision for UK

Main aim:

Ensure UK *maintains* a leading role in development and commercialisation of CATs that can make a significant and affordable reduction in CO₂ emissions from FF use

UK 'Vision':

- Up to 10% of UK power from FF plant + CCS by 2020
- Capabilities enable CCS to make major contribution to 2050 target
- Influencing EU/global policy and positioned for success in global markets

Strategic Objectives

- Support CCS demo programmes
- Ensure CATs (particularly CCS) are affordable, acceptable and commercially available by 2020
- Ensure next gen. techs. (needed for 2050 targets) successfully brought to market by 2030+
- Ensure necessary skills/competencies available

8 Key Areas

- **CCS demonstrations** – several, large-scale, integrated
- **CO₂ storage** – characterisation, relevant UK options
- **Transport infrastructure** – plan & implement at scale
- **Financial incentives** – to ‘bridge the gap’
- **Planning & regulation** – national/international
- **Capacity building** – UK CATs industry/research skills
- **Science & technology RD&D** – underpins all areas
- **Public outreach & education** – stakeholder engagement

8 Key Areas - focus

- **CCS demonstrations** – several, large-scale, integrated
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CCS – Critical Timescales

Activity	Timescale
R&D	Now & continuing
UK regulations	2010, adaptation to 2025
UK Demo #1	Operational 2015
UK Demos #2-4	Commissioned 2016-2018
ETS Phase 3	From 2013
10-12 demos in Europe	Operational 2015-2016
UK CCC targets:	
- CCS on new coal (CCS-R)	2020-2025
- Trivial fossil without CCS	By mid-2020s
Full commercialisation	By 2020
Global CCS to 2050	28 coal+ 52 gas per year (2020-2050)

UK CATs Demos

Technology Area	Demo Needs
CO ₂ Capture (coal): <ul style="list-style-type: none">- Post-comb. capture- Oxy-fuel combustion- Pre-comb. Decarbonisation	600°C plant + PCC operating 2015 100-500MW _e demo 2015 400-800MW _e demo 2016 (UK OEM)
CO ₂ Capture (gas)	CCGT + PCC operating 2016 High H ₂ syngas (internat. collab.) CCGT + pre-comb. (retrofit?)
CO ₂ Transport	Multi-source onshore network 2020
CO ₂ Storage	Initially depleted O/G fields 2020 Appraisal of SA capacity/integrity by 2020, deployment 2020-2030

Themes for RD&D

- **Whole system:** risks, transients, economics, environmental issues
- **Capture:** cost, efficiency penalty, waste heat utilisation (number, timescale)
- **Transport:** logistics, network
- **Storage:** security, monitoring & verification

See fold-out A3 tables – prioritisation: H, M, L

Deployment – CO₂ Capture

Proven	Up to 2020	2025 or 2030
<p>Capture (overview):</p> <ul style="list-style-type: none"> • 0.25-2MW_{th} 	<ul style="list-style-type: none"> • 4 x 300-500MW_e LSIPs. • Plans for FOAK 	<ul style="list-style-type: none"> • 1st >1GW_e plants
<p>Post-comb. capture:</p> <ul style="list-style-type: none"> • 0.25-2MW_{th} 	<ul style="list-style-type: none"> • LSIPs on coal & gas. • Plans for FOAK 	<ul style="list-style-type: none"> • Commercially viable (competitive with wind)
<p>Oxy-fuel combustion:</p> <ul style="list-style-type: none"> • 40MW_{th} burner 	<ul style="list-style-type: none"> • 1st 100-500MW_e LSIP 	<ul style="list-style-type: none"> • Optimised systems/boilers
<p>Pre-comb. decarb.:</p> <ul style="list-style-type: none"> • Components (near commercial scale) 	<ul style="list-style-type: none"> • 1st LSIP 	<ul style="list-style-type: none"> • 1st commercial plants
<p>2nd generation capture:</p> <ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • 1-5MW_e pilot tests 	<ul style="list-style-type: none"> • Commercially available

Deployment – CO₂ Use

Proven	Up to 2020	2025 or 2030
<p>CO₂-EOR:</p> <ul style="list-style-type: none"> • Onshore (WAG/GS) • Limited monitoring (some exceptions) 	<ul style="list-style-type: none"> • Metering/monitoring for fiscal transfer, reporting etc • Halve cost of offshore infrastructure re-use • HSE for dense-phase CO₂ on offshore infrastructure • Maintenance and life-ext. of existing infrast. • Optimise CO₂-EOR within HC recovery strategy • Improve understanding of well barrier/CO₂ interface • Characterise risk, develop mitigation strategies 	<ul style="list-style-type: none"> • Conversion of EOR-driven projects to storage-driven • Well integrity designs for post-op./abandonment • Understand risk profile, management/intervention

Deployment – CO₂ Storage

Proven	Up to 2020	2025 or 2030
<p>Saline Aquifer Storage:</p> <ul style="list-style-type: none"> <li>• Principle demonstrated (3x >0.5Mte/y projects) 	<ul style="list-style-type: none"> <li>• Test design/op. guidelines for UK conditions <li>• Large-scale appraisal prog. (capacity, perm., injectivity) <li>• Test/improve perf. pred. <li>• Identify optimum dev. sequence for key basins <li>• Water extraction/pressure management strategies <li>• Monitoring strategies <li>• Improve understanding of well barrier/CO₂ interface <li>• Characterise risk, develop mitigation strategies 	<ul style="list-style-type: none"> <li>• Optimise basin management strategies <li>• Sweep management strats. in open formations <li>• Use data to understand trapping mechanisms better <li>• Validate performance prediction tools <li>• Well integrity designs for post-op./abandonment <li>• Understand risk profile, management/intervention

Deployment – CO₂ Storage

Proven	Up to 2020	2025 or 2030
<p>Depleted Oil/Gas Fields:</p> <ul style="list-style-type: none"> <li>• Gas fields for gas storage <li>• Pilots of CO₂ injection 	<ul style="list-style-type: none"> <li>• Understand seal integrity/injectivity in high-depletion <li>• Well hydraulic perf. <li>• UK Demos data available <li>• Test/improve perf. pred. <li>• Assess EGR benefits <li>• Monitoring strategies for strata with residual gas <li>• Use of converted pipelines or buoys for CO₂ delivery <li>• HSE of supercrit. CO₂ <li>• Improve understanding of well barrier/CO₂ interface <li>• Characterise risk, develop mitigation strategies 	<ul style="list-style-type: none"> <li>• Sweep strategies in fields with mobile water <li>• Well integrity designs for post-op./abandonment <li>• Understand risk profile, management/intervention

Next Steps...

- Panel and Discussion today
- Comments, further information, etc (particularly on RD&D topics/prioritisation) welcome until 31/3/11: Send to kstech@btinternet.com
- Presentation at UKCCSC Meeting, Falmouth, 5-6/4/11
- APGTF aiming to publish Strategy June/July
- Feed into DECC CCS Roadmap R&D 'chapter'