CALIFORNIA’S LCFS AND CCS PROTOCOL

A summary for policymakers and project developers, and comparison to other regulations in the US

IAN HAVERCROFT
Senior Consultant

ALEX TOWNSEND
Senior Consultant

GLOBAL CCS INSTITUTE
OVERVIEW

• An introduction to the LCFS
• The types of CCS projects that qualify for the LCFS
• The requirements of the CCS Protocol of the LCFS
• A comparison of the CCS Protocol and UIC Program in the US
• The opportunity from combining LCFS credits and 45Q tax credits
AN INTRODUCTION TO THE LCFS
AN INTRODUCTION TO THE LCFS

• Introduced by Executive Order in 2007
• Administered by CARB, which has primacy to regulate GHG emissions in California
• A market-based policy, that places lifecycle carbon intensity targets on all transportation fuels sold in California
• Aims to reduce the lifecycle emissions of transport fuels sold in California
  • Diversifying fuel mix
  • Reducing petroleum dependency
  • Reducing GHG emissions and other air pollutants
• Carbon intensity benchmarks fall over time, with a 20% reduction by 2030 relative to 2010 levels
AN INTRODUCTION TO THE LCFS

CARB sets annual carbon intensity ("CI") target in each year for gasoline and diesel.

Fuels that have a higher CI than the target generate deficits and fuels with a lower CI generate credits.

Fuel providers in California must in each year have enough credits to compensate for deficits.

Fuel providers submit an annual compliance report.

If still in deficit, must purchase credits on the CCM and retire outstanding balance within 5 years.

Options to ensure fuel providers have sufficient credits in a given year:

- Use credits banked from previous years (if available).
- Buy credits from another fuel provider in California, or an opted-in credit generator.
- Increase production or imports of low CI fuels, or reduce imports or production of high CI fuels.
- Change production methods to make fuels less carbon intensive.
- Transfer ownership of the fuel and compliance requirements.
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AN INTRODUCTION TO THE LCFS

![Graph showing percent reduction in carbon intensity from 2010 to 2030.]

- Historic Compliance Targets
- Reported % CI Reduction
- Future Compliance Targets

Carbon intensities based on composite of gasoline and diesel fuels.

![Bar chart showing cumulative credits generated 2011-18 (million tonnes).]

- Renewable Diesel
- Ethanol
- Electricity
- Fossil Natural Gas
- Biomethane
- Biodiesel

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AN INTRODUCTION TO THE LCFS
CCS PROJECTS THAT QUALIFY FOR THE LCFS
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CCS PROJECTS CAN BE USED AS PART OF THESE COMPLIANCE OPTIONS.
# CCS Projects That Qualify for the LCFS

<table>
<thead>
<tr>
<th>Location of CCS project</th>
<th>Anywhere in the world</th>
<th>Anywhere, provided they sell the transportation fuel in California</th>
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<th>Anywhere, provided they sell the transportation fuel in California</th>
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</thead>
<tbody>
<tr>
<td>Storage site</td>
<td>Onshore saline or depleted oil and gas reservoirs, or oil and gas reservoirs used for CO₂-EOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit method</td>
<td>Project-based</td>
<td>Project-based, under the Innovative Crude Provision</td>
<td>Project-based, under the Refinery Investment Credit Program</td>
<td>Project-based or fuel pathway</td>
</tr>
<tr>
<td>Earliest date which existing projects eligible</td>
<td>Any</td>
<td>2010</td>
<td>2016</td>
<td>Any</td>
</tr>
<tr>
<td>Requirements</td>
<td>Project must meet requirements specified in the CCS Protocol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional restrictions</td>
<td>None</td>
<td>Must achieve minimum CI or emission reduction</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
THE CCS PROTOCOL OF THE LCFS
PERMANENCE REQUIREMENTS

Site characterisation and risk assessment

• Site must meet minimum selection criteria
• Provide detailed information on the geological and hydrological characteristics of the storage site
• Complete a risk assessment and risk management plan that quantifies the risk of CO$_2$ leakage for up to 100 years post injection
  • A project cannot qualify for the LCFS if it the risk assessment includes a “High” risk
• Provide computational modelling of the CO$_2$ plume
PERMANENCE REQUIREMENTS

Well construction and corrective action

- Wells must be constructed in a way that prevents the movement of fluids into unauthorised zones, allows appropriate testing and permits continuous monitoring of pressure.
- Deviations in Well Construction Plan must be approved.
- All materials used must meet or exceed international standards.
- A program of testing is required to confirm the site’s integrity.
- Operators must demonstrate how corrective action has remediated any wells requiring it.
Operation

- Specific injection pressures are specified by the Protocol
- Operational requirements concerning injection practices and well maintenance apply
- Threats to the mechanical integrity of a well are to be treated in accordance with the Protocol
PERMANENCE REQUIREMENTS

Testing and monitoring

• A testing and monitoring plan must be prepared by an operator

• An operator must maintain and comply with the plan, to ensure that the CCS project is operating as certified and that the CO₂ injected is permanently sequestered

• Monitoring must continue for at least 100 years post-injection

• Requirements for injection rate and volume, and wellhead and downhole pressure monitoring, CO₂ plume evaluation, demonstration of mechanical integrity and inspections are introduced.
PERMANENCE REQUIREMENTS

Well plugging and abandonment

- Wells must be treated in accordance with an operator’s plan
- The Executive Officer is to be informed prior to plugging, converting or abandoning a well
- Written approval must be received before plugging can be completed
- Following the plugging of a well, a report is to be submitted setting out the method used and confirming that no leaks have been found.
PERMANENCE REQUIREMENTS

Post-injection site care and site closure

- An operator is required to comply with their post-injection site care and site closure plan, following the completion of injection.
- Injection wells are to be plugged within 24 months of injection being completed.
- 15 years post-injection, the operator may submit evidence to CARB to demonstrate stabilization of the CO\textsubscript{2} plume. If approved, all remaining open wells may be plugged and abandoned.
- Site closure may only occur at least 100 years after injection has been completed.
INSURANCE AND FINANCIAL MECHANISMS

**BUFFER ACCOUNT**

- **Purpose**: CO₂ leak
- **Contribution**: Project operators contribute 8% to 16.4% of credits generated to the Buffer Account, depending on the site risk assessment provided for Permanence Certification.

**FINANCIAL INSTRUMENT**

- **Purpose**: Bankruptcy
- **Contribution**: Project operators maintain a financial instrument sufficient to cover cost of hiring third party to perform corrective action, well plugging, and post site care and closure.
# CREDITING (ACCOUNTING REQUIREMENTS)

<table>
<thead>
<tr>
<th>Example projects</th>
<th>PROJECT BASED CREDITING</th>
<th>FUEL PATHWAY CREDITING</th>
</tr>
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<tbody>
<tr>
<td>DAC projects, CCS at refineries</td>
<td>Ethanol</td>
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</table>

| Estimate of no. credits | CO\textsubscript{2} injected – GHG emissions of CCS project | (CI benchmark – CI fuel) * Energy economy ratio * conversion factor |

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<tr>
<th>Verification</th>
<th>Quarterly or annually</th>
</tr>
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</table>

| Entity that receives credits | Capture operator |
A COMPARISON OF THE CCS PROTOCOL TO THE UIC AND GHGR PROGRAMS
THE UIC AND GHG REPORTING PROGRAMS

Operators in the US injecting CO₂ underground must report information to the EPA under Subpart RR or UU of the GHG Reporting Program (Section 3.0)

Operators in the US must obtain a permit to inject CO₂ underground under the federal or state-level Underground Injection Control (“UIC”) Program (Section 3.0)

CCS project operators that sell fuel into California or directly capture CO₂ from the air can claim LCFS credits, provided they meet the requirements of the CCS protocol (Section 2.0)

Operators in the US that demonstrate secure geologic storage of CO₂ can claim 45Q tax credits (Section 4.0)
COMPARISON TO THE CCS PROTOCOL

<table>
<thead>
<tr>
<th>PHASE OF PROJECT</th>
<th>CLASS II WELLS CO2 INJECTED FOR EOR*</th>
<th>CLASS VI WELLS DEDICATED GEOLOGICAL STORAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitting</td>
<td></td>
<td></td>
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<tr>
<td>Well construction and corrective action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testing and monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plugging and abandonment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-injection site care and closure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance and financial mechanisms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td></td>
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</tr>
</tbody>
</table>

* Class II permit holders assumed to report under Subpart RR. Based on federal requirements of the UIC Program.
THE OPPORTUNITY FROM COMBINING LCFS CREDITS AND 45Q TAX CREDITS
45Q TAX CREDITS

- Introduced in 2008 under the Energy Improvement and Extension Act in the US
- Provides capture operators with credits for each tonne of CO$_2$ stored or utilised that can be used to reduce their tax liability
- Recently amended under the Bipartisan Budget Act in 2018, which included an increase to the tax credit value
- IRS are currently consulting on issues arising from the amendments

<table>
<thead>
<tr>
<th>Tax credit value ($/tCO$_2$)</th>
<th>2019</th>
<th>…</th>
<th>2026</th>
<th>2026 onwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated geological storage</td>
<td>31</td>
<td>…</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>CO2-EOR</td>
<td>19</td>
<td>…</td>
<td>35</td>
<td>Indexed to inflation</td>
</tr>
<tr>
<td>Other CO2 utilisation</td>
<td>19</td>
<td>…</td>
<td>35</td>
<td></td>
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</tbody>
</table>
# A Comparison of the LCFS and 45Q Eligibility Requirements

<table>
<thead>
<tr>
<th></th>
<th>LCFS</th>
<th>45Q</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographic Scope</strong></td>
<td>Anywhere provided they sell fuel into California (with exception for DAC projects)</td>
<td>Anywhere in the US</td>
</tr>
<tr>
<td><strong>Types of CCS Project</strong></td>
<td>Any fuel production facility or DAC facility that captures and either stores CO₂ or injects for CO₂-EOR onshore</td>
<td>Any industrial or DAC facility that stores CO₂ or uses it for EOR or other utilisation purposes</td>
</tr>
<tr>
<td><strong>Minimum Project Size</strong></td>
<td>None</td>
<td>Minimum thresholds for all projects exist</td>
</tr>
<tr>
<td><strong>Emissions Covered</strong></td>
<td>CO₂, CH₄, N₂O, VOCs and CO</td>
<td>Carbon oxide</td>
</tr>
<tr>
<td><strong>Qualification Period Restrictions</strong></td>
<td>None</td>
<td>Construction must begin by 1 Jan 2024</td>
</tr>
<tr>
<td><strong>Credit Generation Duration</strong></td>
<td>Duration of injection</td>
<td>12 years</td>
</tr>
<tr>
<td><strong>Credit Buffer &amp; Invalidation</strong></td>
<td>CCS projects must contribute to the Buffer Account</td>
<td>IRS is currently consulting on the approach to the recapture of tax credits in the event of leakage</td>
</tr>
<tr>
<td><strong>Permanence Requirements</strong></td>
<td>Demonstrated through receiving and maintaining Permanence Certification under the LCFS</td>
<td>IRS is currently consulting on the permanence requirements</td>
</tr>
</tbody>
</table>
Please submit your questions in English directly into the GoToWebinar control panel.
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Please submit any feedback to: webinar@globalccsinstitute.com

You can contact us directly at:

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