CHALMERS
UNIVERSITY OF TECHNOLOGY

Carbon Credits in California's Climate Programs

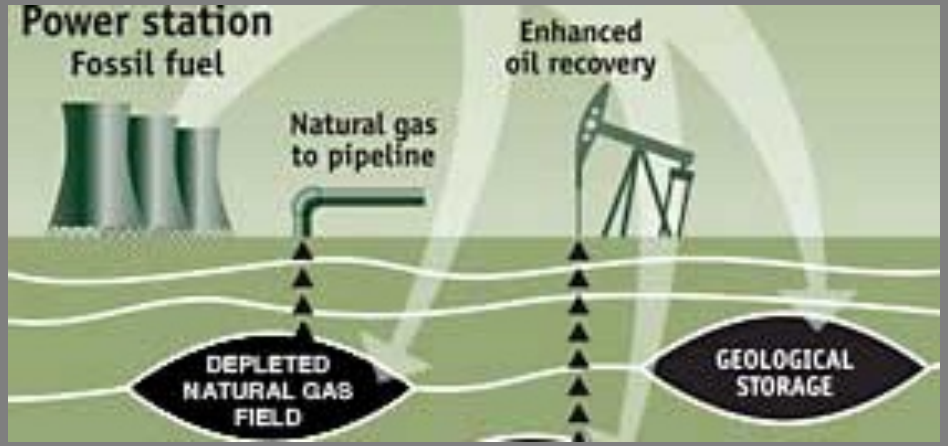
Sonia Yeh
Department of Space, Earth and Environment
Chalmers University of Technology, Sweden

Incentivising Carbon Dioxide Removal Technologies
ERCST
September 24th 2019

Overview

- CCS in California
- Carbon policy in California: carbon cap-and-trade and the Low Carbon Fuel Standard (LCFS)
  - Design principles of each policy
  - Why is CCS under the LCFS?
  - Status of the LCFS
- Final thoughts

CALIFORNIA
CLIMATE CHANGE



Accounting and Permanence Protocol for Carbon Capture and Geologic Sequestration under the LCFS (CCS Protocol)

Nov 2017

Eligible CCS Projects

- CO_2 storage potential in CA
  - 30–420 Gigatonne onshore formation capacity (California Geological Survey, 2011)
  - Offshore sub-seabed offers additional capacity
- Applicable to CCS projects that capture CO_2 and sequester CO_2 in:
  - CO_2-EOR reservoirs
  - Saline formations and
  - Depleted oil and gas reservoirs without oil and gas recovery
- Covers any capture methods as long as CO_2 is geologically sequestered
  - Includes Direct Air Capture

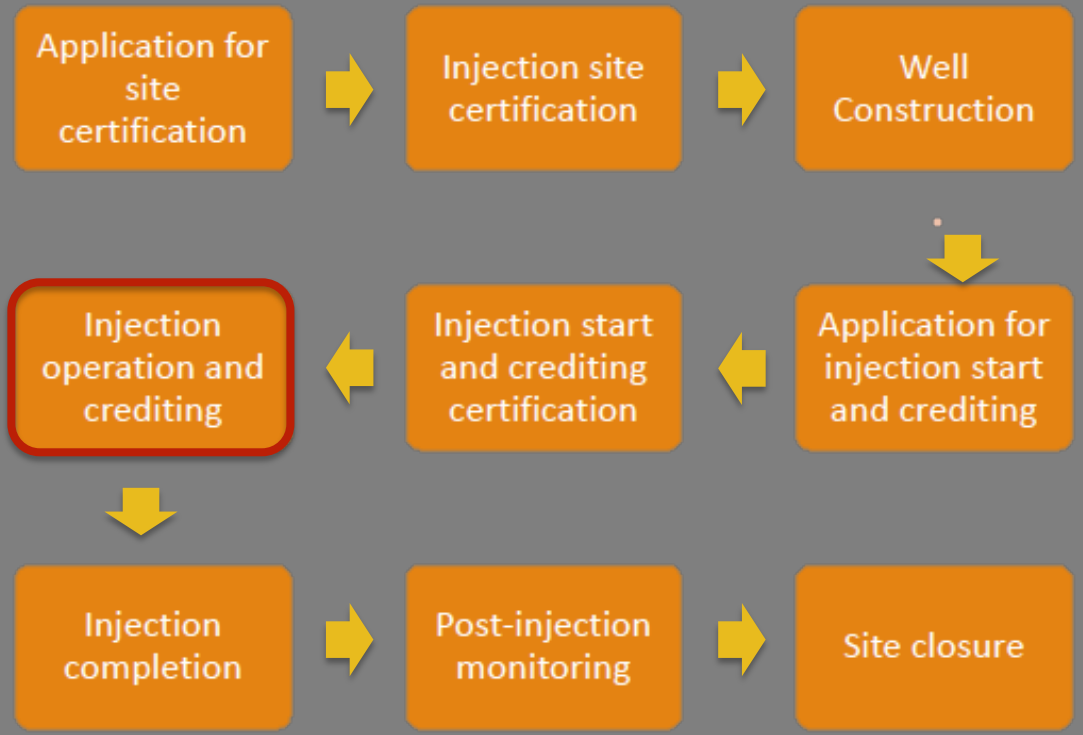
CALIFORNIA
AIR RESOURCES BOARD

CCS Projects in LCFS

- Credits go to capture facility
- Current proposal: storage facility must be co-applicant
- Capture and storage facilities do not need to be co-located
- Must comply with CCS protocol
- No credits issued until CCS Protocol is approved and project meets all protocol requirements

CALIFORNIA
AIR RESOURCES BOARD

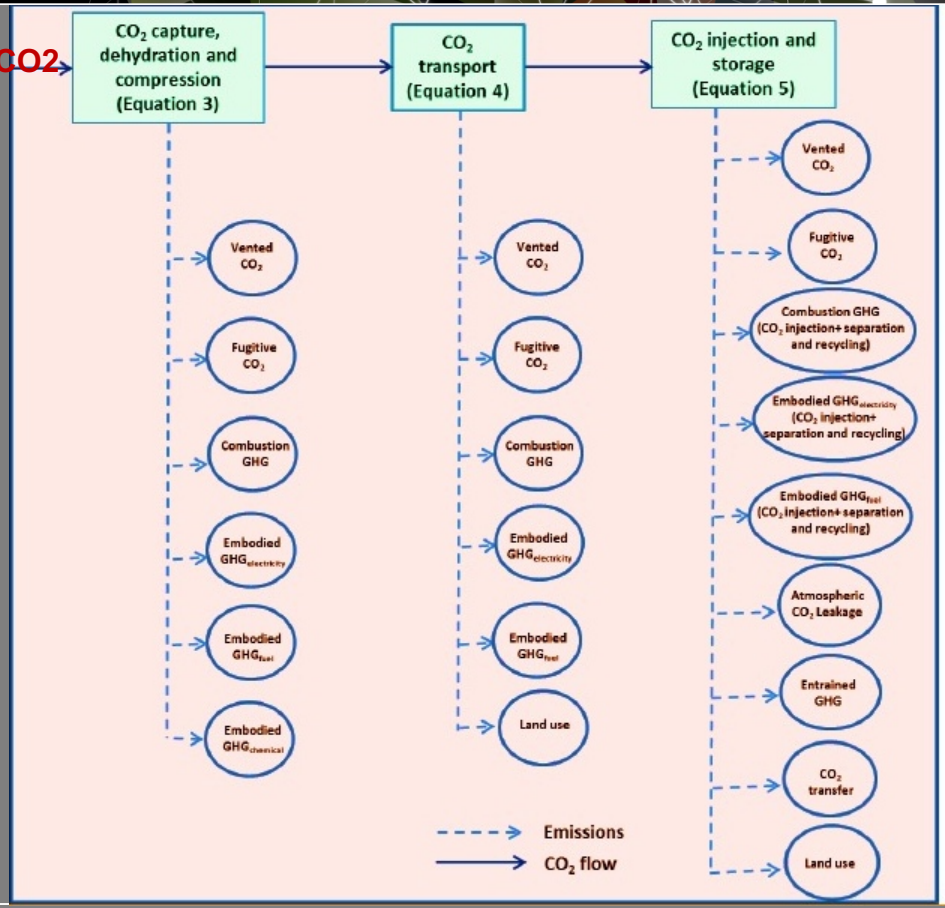
Project Process Under CCS Protocol



CALIFORNIA
AIR RESOURCES BOARD

LCA System Boundary: Storage in CO2-EOR Reservoirs

CCS Credit = CO_2 Injected - Project GHG emissions



CALIFORNIA AIR RESOURCES BOARD

Overview of the LCFS /Clean Fuel Standard

- A performance-based approach that incents the use of a broad range of low carbon fuels, energy sources and technologies in transportation
- Carbon intensity (gCO_2/MJ): lifecycle emissions (basis for fuels generating credits or deficits)
- Jurisdictions implementing LCFS include California, Oregon, and British Columbia.
  - Canada announced on November 25, 2016 that it would develop a clean fuel standard (include industry and building). A draft version of the regulatory framework was published in December 2017

Standards and taxes on fuels: What's the differences?

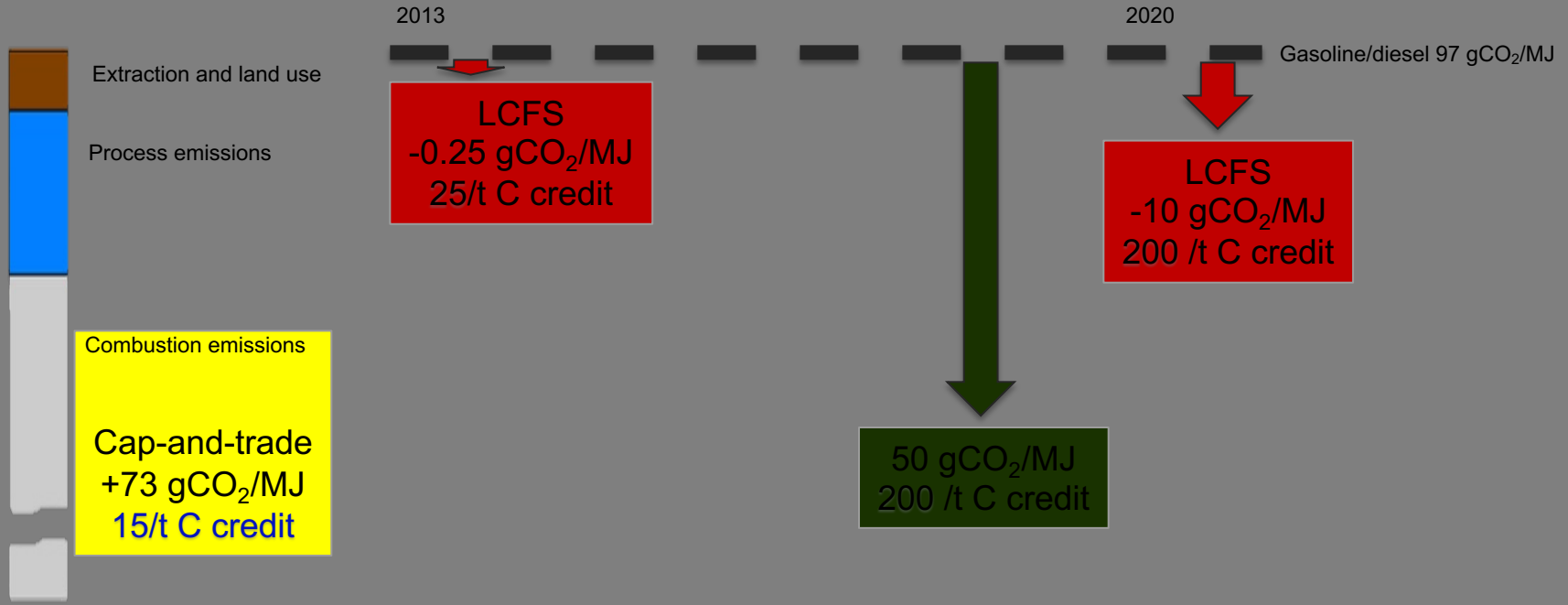
LCFS vs. Cap-and-trade

	Cap-and-Trade	LCFS
Credit/allowance price	$12.5/allowance (floor)	$200/credit
Coverage	All major sources including utilities, industry, and transportation	Transportation fuels
Unit of C credit	ton C emitted under the cap	**ton C emitted** *above* or *below* the intensity standard **per 10^6 MJ** fuel
Emissions covered	Combustion emissions	Lifecycle emissions

LCFS vs. Cap-and-trade:

(1) different quantities of carbon emissions are priced;

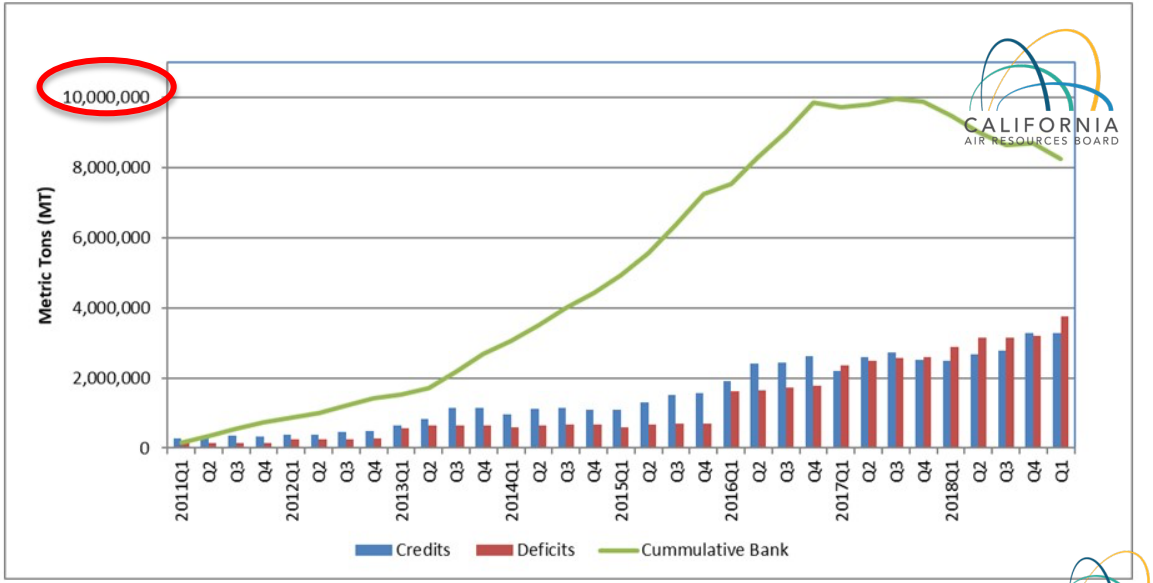
(2) price levels of credits are different



Credits and deficits

- Up to 2017, regulated parties have consistently over-complied with the standard.
- Large banked credits, though the standard is becoming more stringent.

Total Credits and Deficits for All Fuels Reported and Cumulative Credit Bank
Q1 2011 – Q1 2019



This chart shows the total deficits (in red) and credits (blue) generated during each quarter. The green line tracks the total number of banked credits.

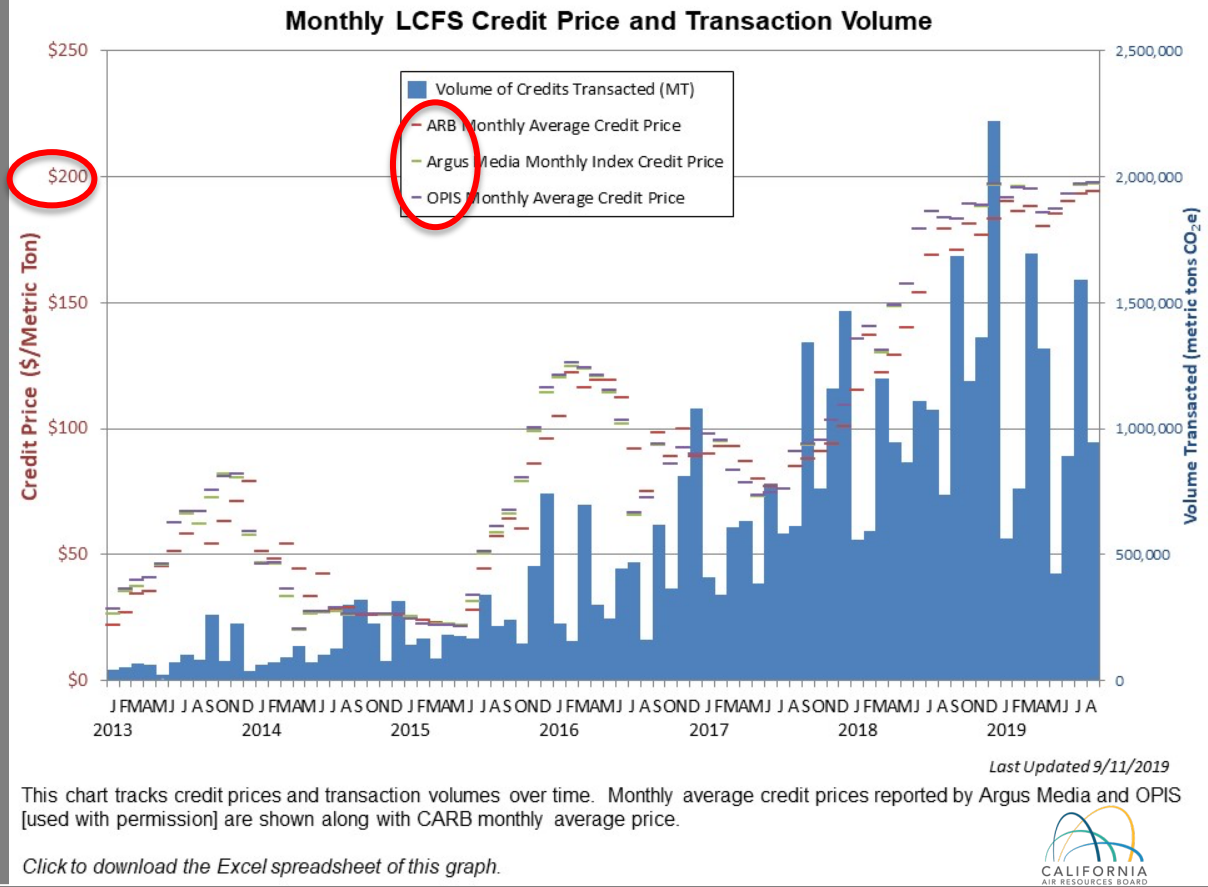
Regulated entities have consistently over-complied with the standard, generating a bank of credits which can be sold or retired to meet compliance obligations at any time. At the end of Q1 2019, the bank stood at nearly 8.2 million credits. No 2018 or 2019 Low Complexity/Low Energy Use Refining credits have been included as of this publication. As the standard becomes more stringent in order to reach the targeted reductions by 2030, regulated entities can rely on these banked credits to ease compliance.

Click to download the Excel spreadsheet of this graph.

https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm

Credit price and transaction volume are increasing

- Over 30 MMT LCFS credits generated.
- The overall nominal value of all credit transfers is over 3.1 billion USD to date.



Alternative jet fuels (AJF) as opt-in credit-generating fuels

- AJF not subject to the LCFS regulation and would therefore not generate deficits
  - opt-in AJF pathways would be eligible to generate credits for the total volume loaded to planes in California, whether the destinations are in California or out of the state
- Benefits
  - reductions in global GHG emissions
  - Increase in investment and off-take agreements
  - reduce criteria pollutant emissions during taxi, takeoffs, and landings, which could improve air quality

Maritime

- Fuels in ocean-going vessels are exempted
  - fuel in recreational and commercial harbor craft are not exempt
- Some options to cover electricity-at-berth — shore power to ocean-going vessels

Other considerations

”The CSU concept complements existing policies that are based on pricing avoided CO2 emissions”

> ”It has achieved traction with the some of the major oil companies (Shell, BP, Aramco), hydrocarbon producing countries (including Norway) and is supported by the World Bank’s climate change group”

- What is the baseline emission (to calc CO_2 avoided)?
- Who has the authority in determining and validating credits, deciding the rules (e.g. non-compliance), and monitoring the market?
- What sets the price?
  - Prices are determined by obligations or carbon markets elsewhere if credits are fungible

Sonia Yeh
Sonia.yeh@chalmers.se

Department of Space, Earth and Environment
Chalmers University of Technology
Gothenburg, Sweden

CHALMERS
UNIVERSITY OF TECHNOLOGY