California Environmental Protection Agency

Air Resources Board

California Low Carbon Fuel Standard

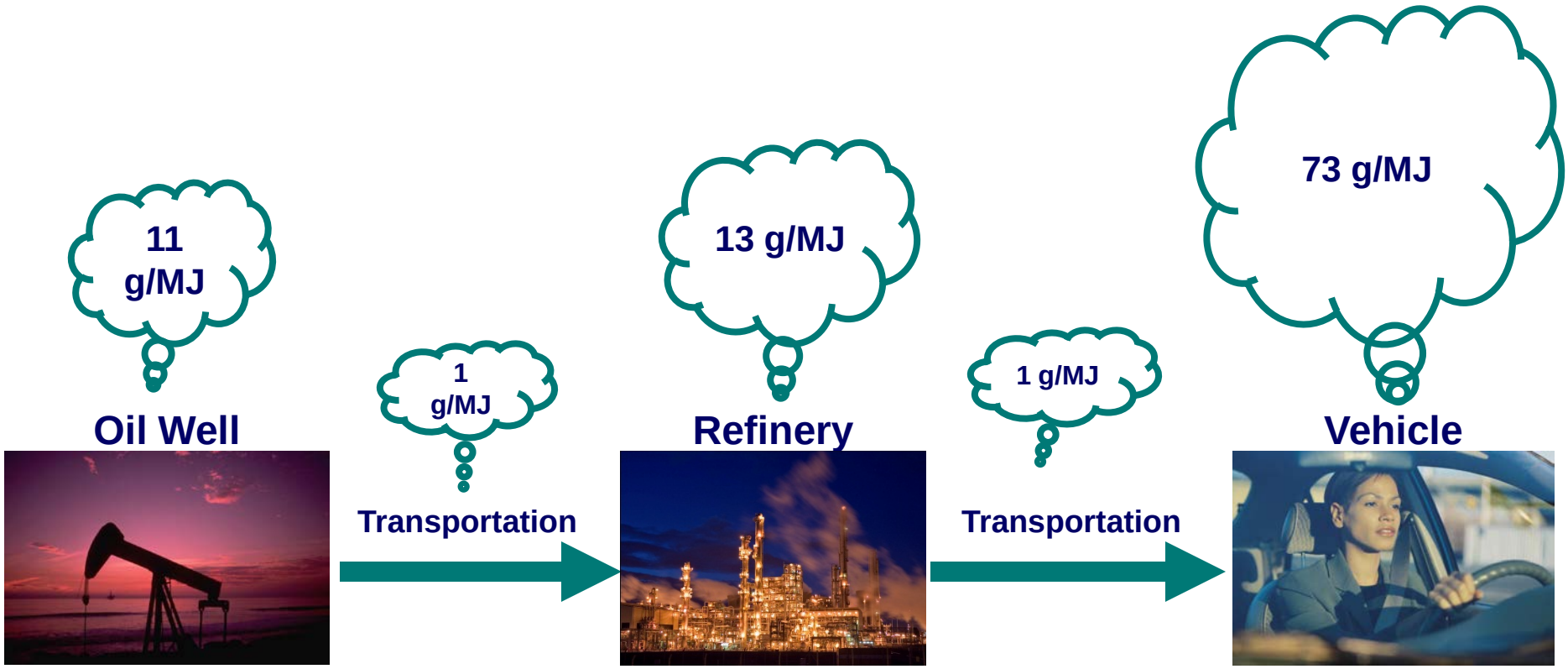
LCFS Key Objectives

- Reduce carbon intensity of transportation fuel pool by 10% by 2020
- Reduce greenhouse gas emissions (~15 million metric tons in-state in 2020)
- Help achieve AB 32 objective of reducing GHG emissions to 1990 levels by 2020
- Transform State's fuel supply, reducing GHG emissions, and enhancing energy independence/security

Basic LCFS Requirements

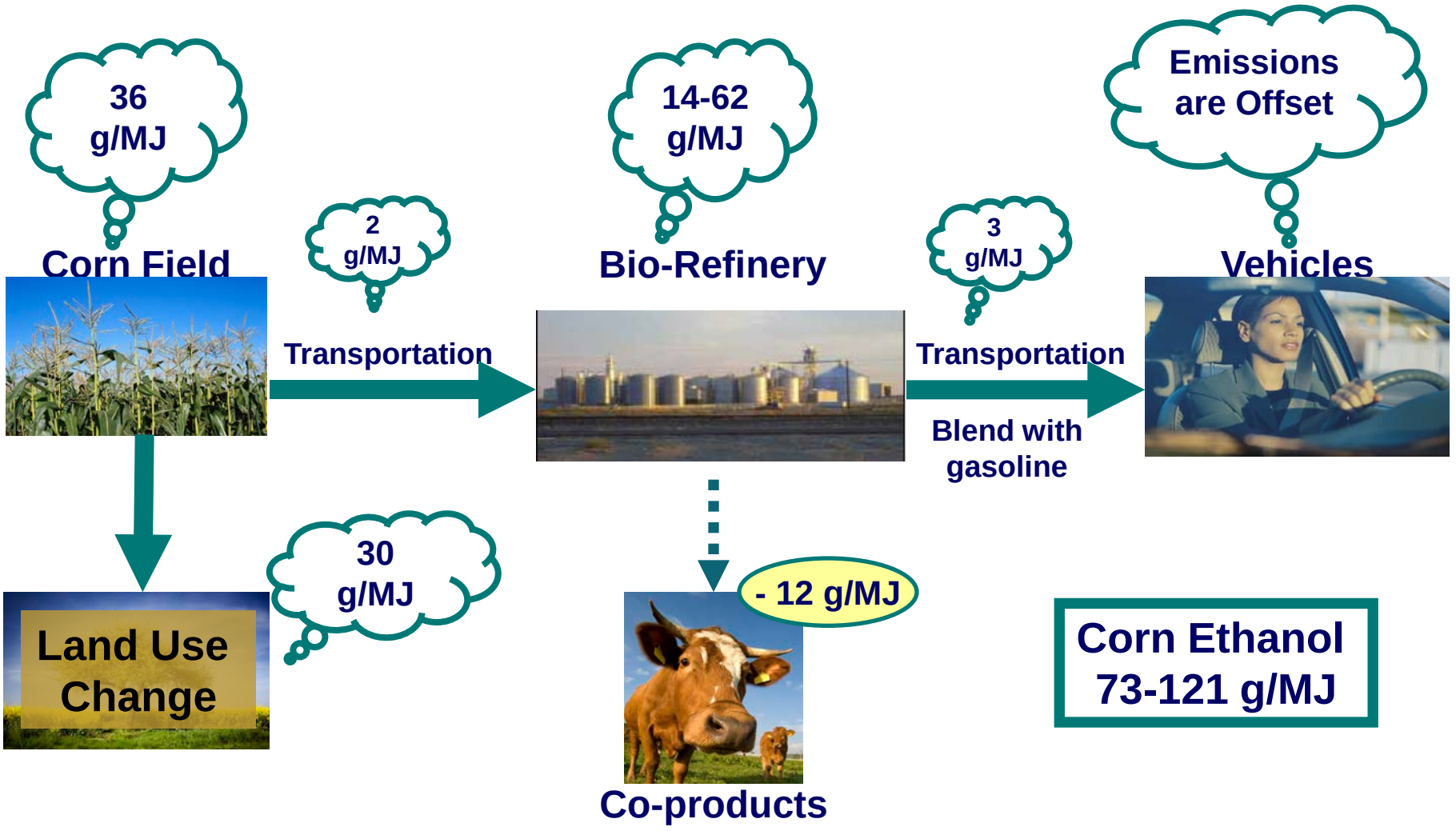
- Sets annual carbon intensity standards for gasoline, diesel, and the fuels that replace them
- Carbon intensity (CI) is the measure of GHG emissions associated with producing, transporting, and consuming a fuel (gCO_2e/MJ)
- CI based on complete life cycle analysis

Fuel Life Cycle – Gasoline



Gasoline
99 g/MJ

Fuel Life Cycle – Corn Ethanol

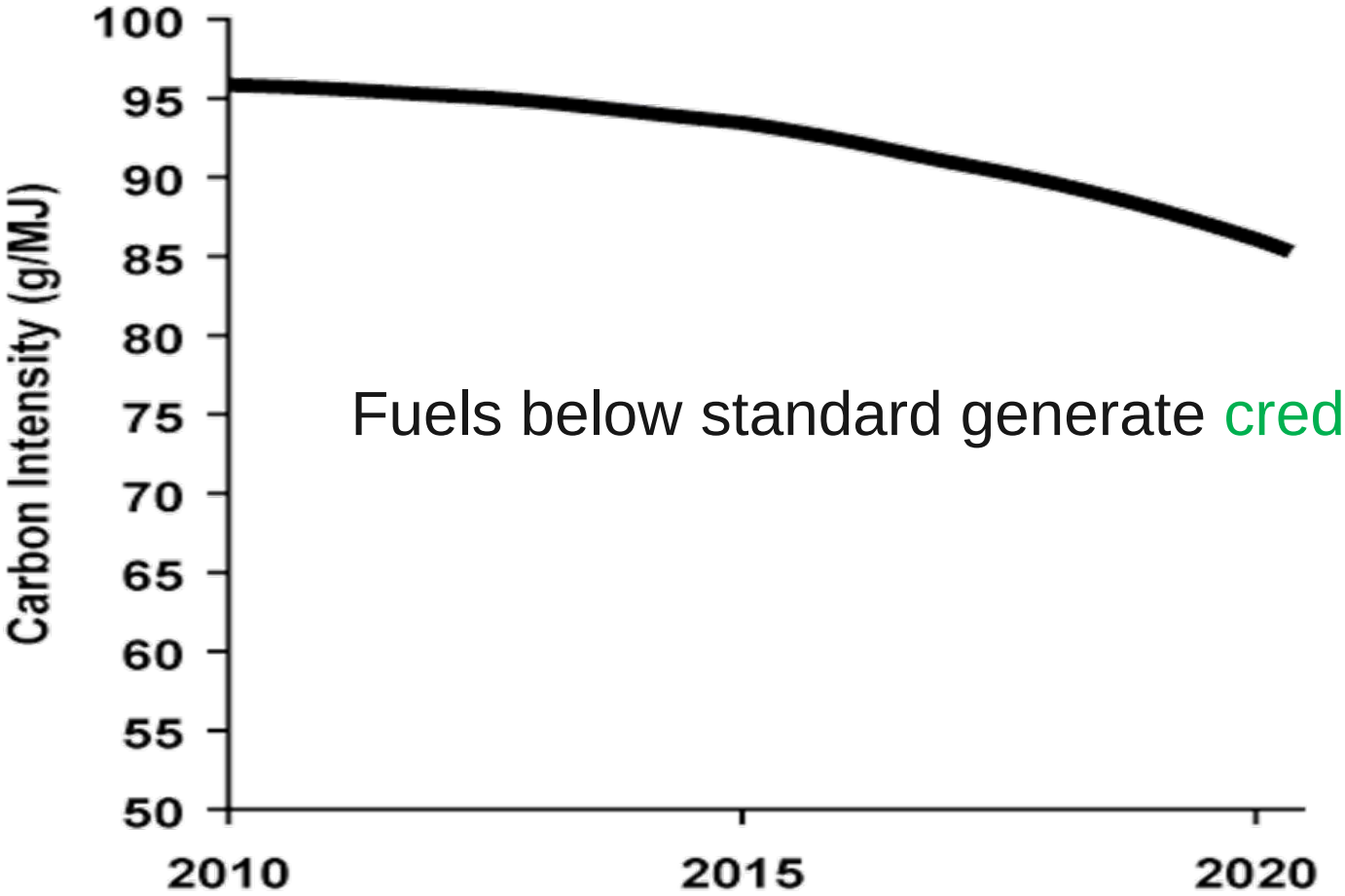


LCFS Applies to Regulated Parties

- Providers in California of most petroleum and biofuels are “regulated parties” under the LCFS
- Providers of clean fuels that already meet 2020 target are exempt but can “opt in” to program and earn credits
  - Electricity
  - Hydrogen
  - Natural gas & biogas
- Generated credits can be bought and sold by regulated parties

Schedule Provides Time for Fuel Advances

Fuels above standard generate deficits



Fuels below standard generate credits

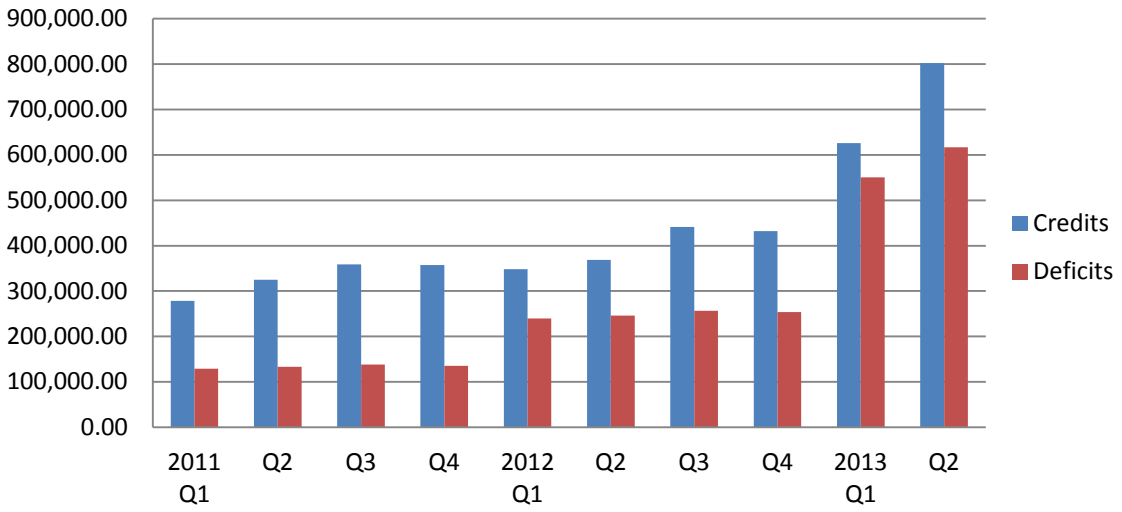
Carbon Intensities of Some Fuels

- Gasoline 99 gCO_2e/MJ
- Diesel 98 gCO_2e/MJ
- Corn Ethanol 73 - 121 gCO_2e/MJ
- Sugarcane Ethanol 58 – 73 gCO_2e/MJ
- Biodiesel 4 – 83 gCO_2e/MJ
- Methane -15 – 83 gCO_2e/MJ
- Electricity 35 – 46 gCO_2e/MJ

LCFS Working As Designed

- Approximately 100 fuel providers are reporting & complying
- Credits being accrued, tradable any time (1,640,000 “excess” credits)

Fig. 1. Total Credits and Deficits (All Fuels) Reported, Q1 2011 -- Q2 2013



LCFS Credits

- Source of credits (Q2 2013)
  - 78% from low-CI ethanol
  - 10% from natural gas
  - 8% from biodiesel
  - 3% from renewable diesel
- Credit transactions
  - 1 LCFS credit transaction in 2011
  - ~145 LCFS credit transactions through September 19, 2013
    - Current price range: $55 - $70/MT
    - Trade volumes: 13 – 47,505 credits/trade

LCFS Activities

- Will re-adopt LCFS in 2014
- Working on revisions to LCFS
- Adding biofuel production facilities to Registration Program
- Adding new fuel pathways via Method 1, 2A, and 2B
- Working on LCFS sustainability provisions
- Re-examining indirect land use change (iLUC) values for corn ethanol, sugarcane, ethanol, and soy biodiesel
- Determining carbon intensity of marketable crude oils with newly developed estimator tool

LCFS Challenges

Slow roll-out of low-CI fuels, especially cellulosic ethanol (LCFS, federal Renewable Fuel Standard [RFS2]); however,

- Relatively inexpensive natural gas may play a larger role
- Increasing interest in biomethane (landfills and digesters)
- Large volumes of renewable diesel coming to California

LCFS Today

- LCFS working well
- Regulated parties are over-complying, generating credits for future compliance
- Current impact on fuel prices indiscernible at the pump
- Innovations are occurring
- Investments in alternative fuels are increasing
- Challenges remain later in the decade

Thank You

http://www.arb.ca.gov/fuels/lcfs/lcfs.htm