What is a Low Carbon Fuel Standard?

Coralie Cooper
Transportation Program Manager
ccooper@nescaum.org

Matt Solomon
Mobile Source Analyst
msolomon@nescaum.org

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What is an LCFS?

- Performance-based standard for fuels
- Regulates “carbon intensity” or lifecycle carbon emissions from fuels
- Requires displacement of “high” carbon fuels with fuels that have low carbon intensities, such as:
  - Low carbon biofuels or feedstocks
  - Electricity generated with renewable sources
  - Hydrogen produced from renewable sources
- Penalizes fuels that are carbon intensive, such as:
  - Petroleum derived from tar sands
  - Fuel derived from coal gasification
  - Hydrogen derived from tar sands or coal gasification
  - Electricity derived from carbon intensive processes

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What is an LCFS? (continued)

- Would require reductions in carbon intensity from today's transportation fuels:
  - Gasoline and diesel
- Requires lifecycle GHG accounting for gasoline, diesel, biofuels, unconventional fuels, and low carbon alternatives
- Heating oil could be included – to be discussed
- NOT A CAP ON TRANSPORTATION FUEL-RELATED EMISSIONS

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How is the LCFS similar to other fuels and/or vehicle regulations?

- Emissions rate of pollutant regulated:
  - Example: g/mi CO_2 in CA vehicle GHG standards
  - NOx emissions rate of reformulated gasoline
  - Grams of CO_2 per megajoule of energy (gCO_{2e}/MJ) in the LCFS
- Total emissions not capped in the above examples
  - Total vehicle related CO_2 increases as the vehicle fleet grows and VMT increases
  - Total fleet NOx emissions increase when more reformulated gasoline is sold
  - Total fuel-related GHG emissions increase as more fuel is sold

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How is the LCFS Different From Other Regulations?

- Vehicle standards regulate the specified emissions coming from the tailpipe
- Fuel standards regulate tailpipe emissions of ozone forming pollutants (for example)
- LCFS regulates GHG emissions from full fuel lifecycle:
  - Production of fuel
  - Transportation of fuel
  - Combustion of fuel
  - Much broader in scope

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What is Lifecycle Analysis?

- An accounting of the emissions associated with each stage in the life of a product:
  - » Production
  - » Transport
  - » Storage
  - » Delivery
  - » End Use
- “Cradle-to-Grave”, “Well-to-Wheels”, “Full Fuel Cycle”…
- Simple addition…

  …but keeping track of every stage can be very complicated!

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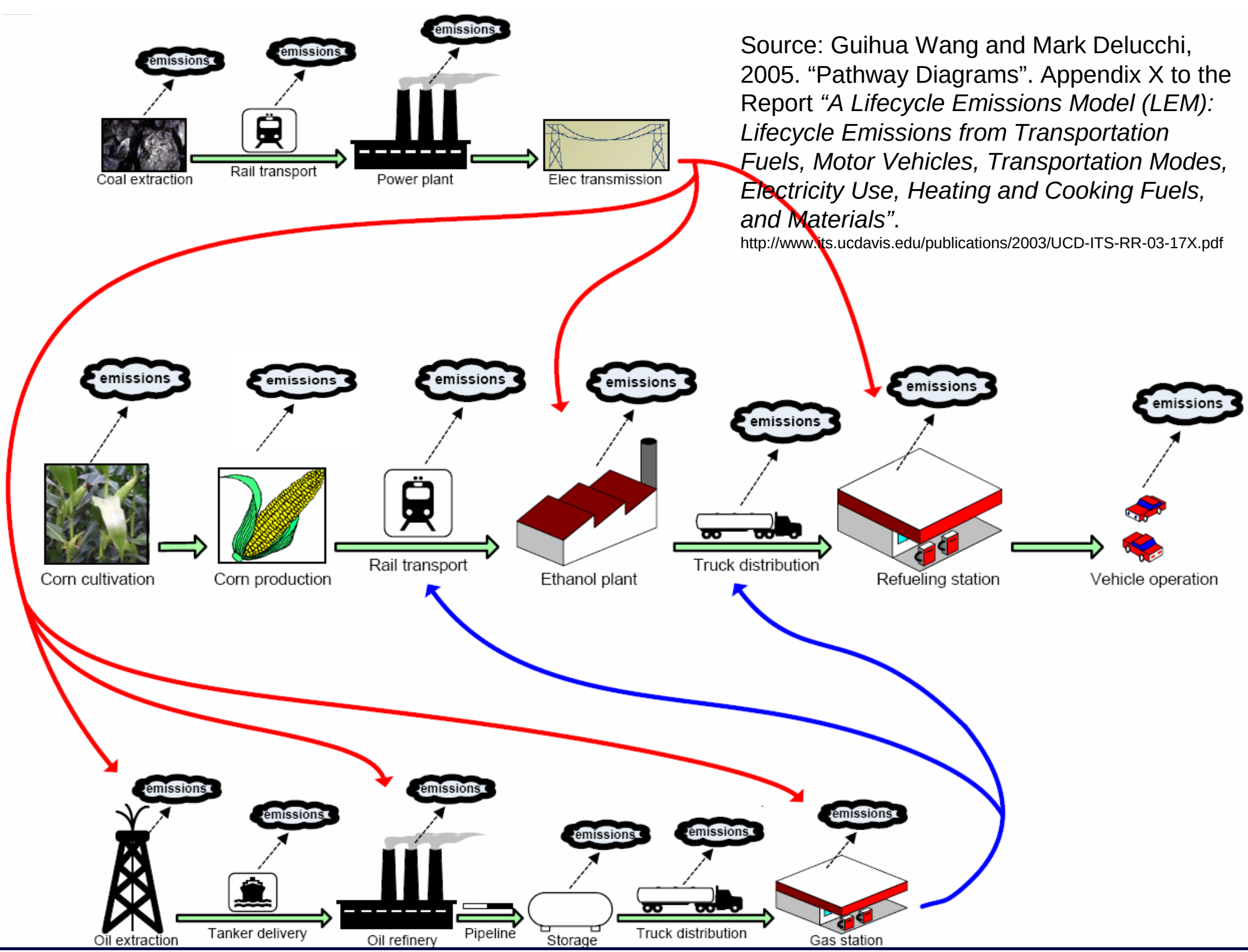

Source: Guihua Wang and Mark Delucchi, 2005. "Pathway Diagrams". Appendix X to the Report *"A Lifecycle Emissions Model (LEM): Lifecycle Emissions from Transportation Fuels, Motor Vehicles, Transportation Modes, Electricity Use, Heating and Cooking Fuels, and Materials"*.

http://www.its.ucdavis.edu/publications/2003/UCD-ITS-RR-03-17X.pdf

Example CI Calculation: Conventional Gasoline (Draft Results)

	Well-To-Tank Carbon Intensity:	**16.9** gCO_2e/MJ
+	Carbon Content of Fuel:	**72.9** gCO_2e/MJ
+	Vehicle emissions of CH4 and N20:	**2.47** gCO_2e/MJ
=	Lifecycle Carbon Intensity:	**92.3** gCO_2e/MJ

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