



California Green Summit

Future Fuels and Feedstocks

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Alternative Fuels in California

- Cap-and-Trade Program
 - Eligible biofuels have no compliance obligation
 - Most recent auction settlement price was \$12.73



Alternative Fuels in California (Cont.)

- Low Carbon Fuel Standard
 - Fuels are scored by carbon intensity, lower carbon fuels generate higher credits
 - Credits = one tonne of CO₂e, ~\$120



Alternative Fuels in California (Cont.)

- Zero Emissions Vehicle (ZEV)



- Short-Lived Climate Pollutants (SLCP)



- Very Low Carbon Fuel Incentive

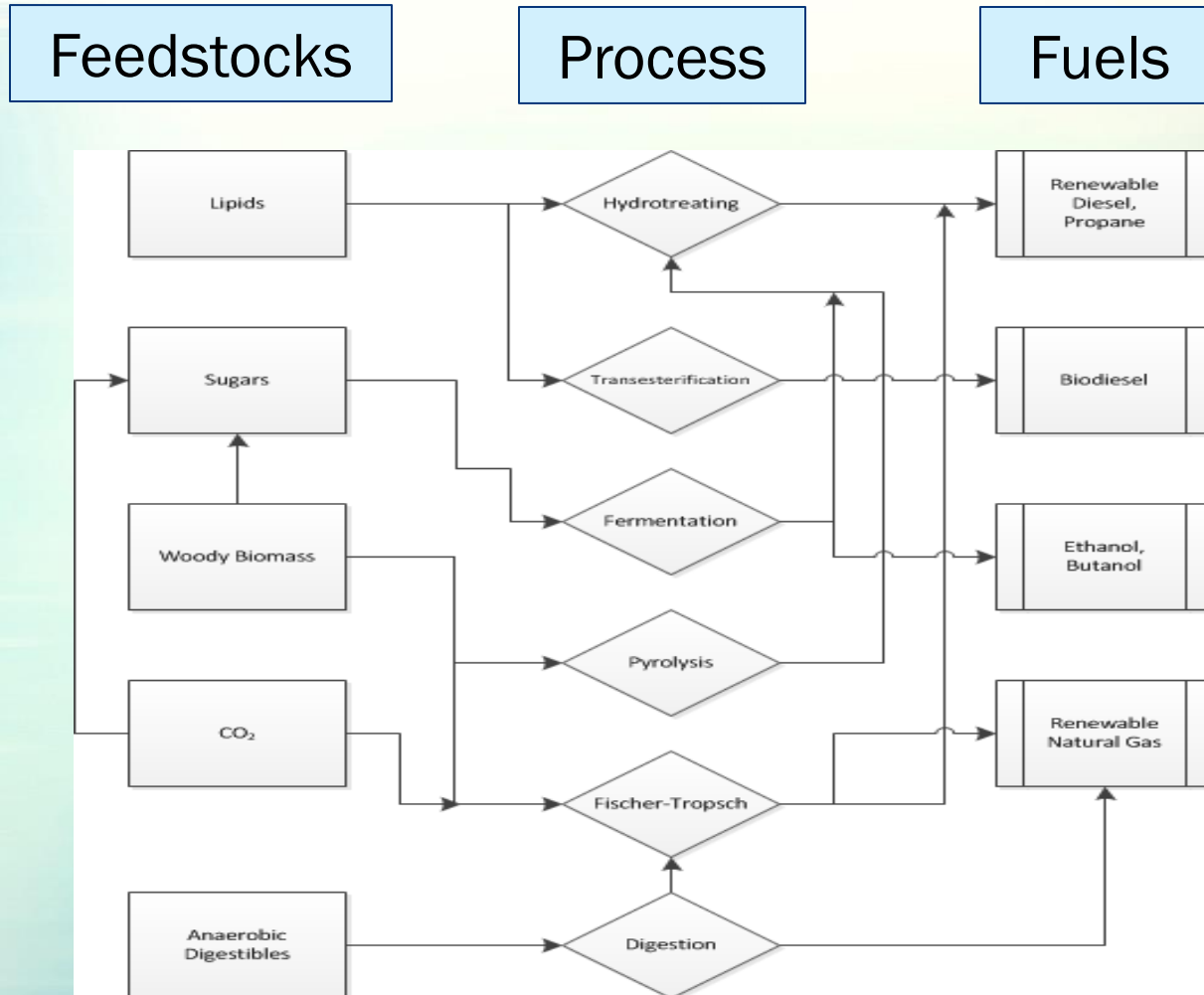


Feedstock Drives Fuel Carbon Intensity

- Bio feedstocks generally reduce carbon
 - Corn ethanol CI ~ 76 gCO₂e/MJ
 - Soy biodiesel CI ~ 53 gCO₂e/MJ
- Waste or residue feedstocks can go lower
 - Landfill RNG CI ~ 23 gCO₂e/MJ
 - Used Cooking Oil Biodiesel CI ~ 19 gCO₂e/MJ
 - Anaerobic Wastewater RNG CI ~ 8 gCO₂e/MJ



Feedstocks Can Often be Used for Different Fuels



Feedstocks for Alternative Fuels

- Lipids
- Sugars/starches
- Woody/herbaceous biomass
- Anaerobic digestibles
- CO₂



Feedstock: **Lipids**

- Includes animal fats, vegetable oil, and algae oil
- Fuels
 - Biodiesel (transesterification)
 - Renewable diesel (hydrotreating)
 - Propane (renewable diesel by-product)



Feedstock: **Sugars/Starches**

- Can be derived from sugar/starch bearing plants (corn, cane) or cellulosic hydrolysis
- Fuels
 - Ethanol, or butanol (direct fermentation)
 - Renewable diesel
(fermentation then hydrotreating)



Feedstock:

Woody/herbaceous biomass

- Includes energy crops such as miscanthus, willow, grass, or forest residue
- Fuels
 - Ethanol (hydrolysis and fermentation)
 - Renewable diesel (Fischer-Tropsch)
 - Renewable gasoline (pyrolysis and co-processing)



Feedstock:

Anaerobic digestibles

- Includes Landfill gas, municipal wastewater, dairy manure
- Fuels
 - Renewable natural gas (anaerobic digestion)
 - Renewable diesel (digestion and Fischer-Tropsch)



Feedstock: CO₂

- Can come from electrical power plants, any number of industrial sources, or from the atmosphere
- Generally research stage
- Can be used to produce a number of other feedstocks or fuels including sugars, renewable diesel, and renewable natural gas



Contact Info

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