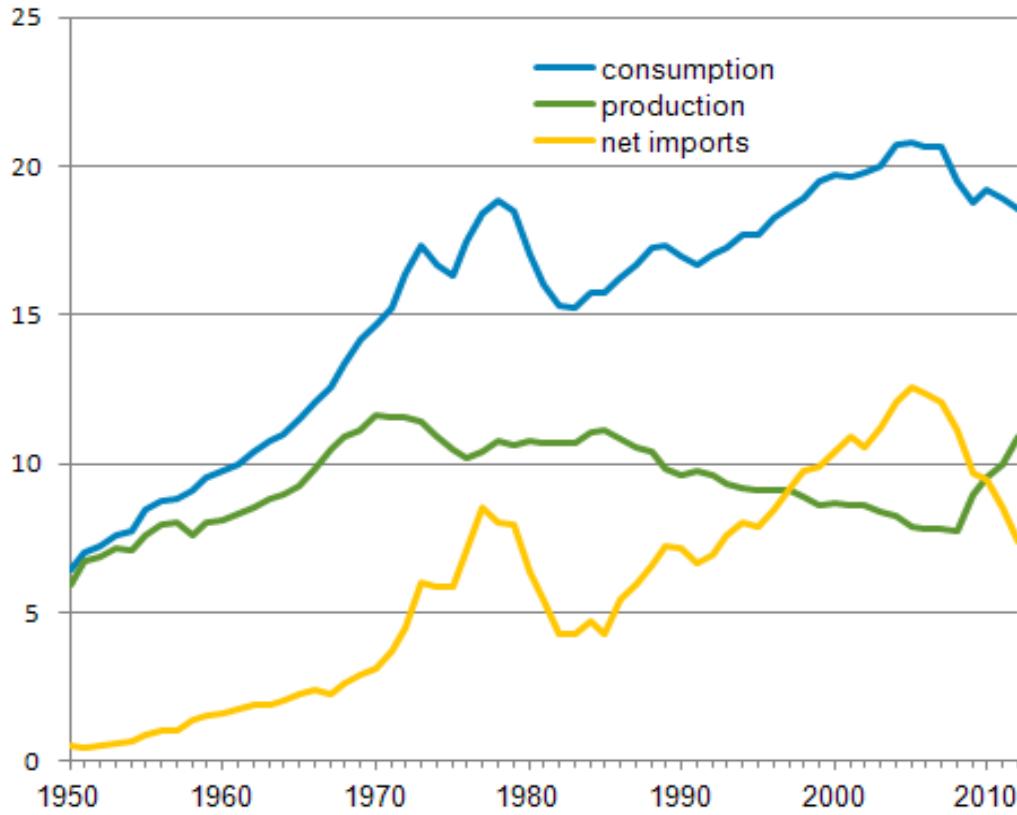


Green Diesel and Renewable Jet: middle distillate bio-based fuel for agriculture and aviation

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We are in the midst of a hydrocarbon renaissance

U.S. petroleum and other liquids consumption,
production, and net imports (1950-2012)
million barrels per day



Including gas condensates
the US in 2015 will
overtake Saudi Arabia
as the largest liquid hydrocarbon
producer in the world

Source: U.S. Energy Information Administration, *Monthly Energy Review*,
Table 3.1 (April 2013), preliminary 2012 data, and *Annual Energy Review*,
Table 5.1b (August 2012).

Substantive changes in the fleet appear realistic



BIOMASS POWERED!



Why biofuel remain relevant

No substitute for high energy density liquid fuel in some applications
Powerful drivers for drop-in biofuel remain



Aviation:

Low emissions
Sustainability
Feedstock diversification

Agriculture:

Sustainability
Decoupling from oil economics
Food vs. Fuel
Local reliance

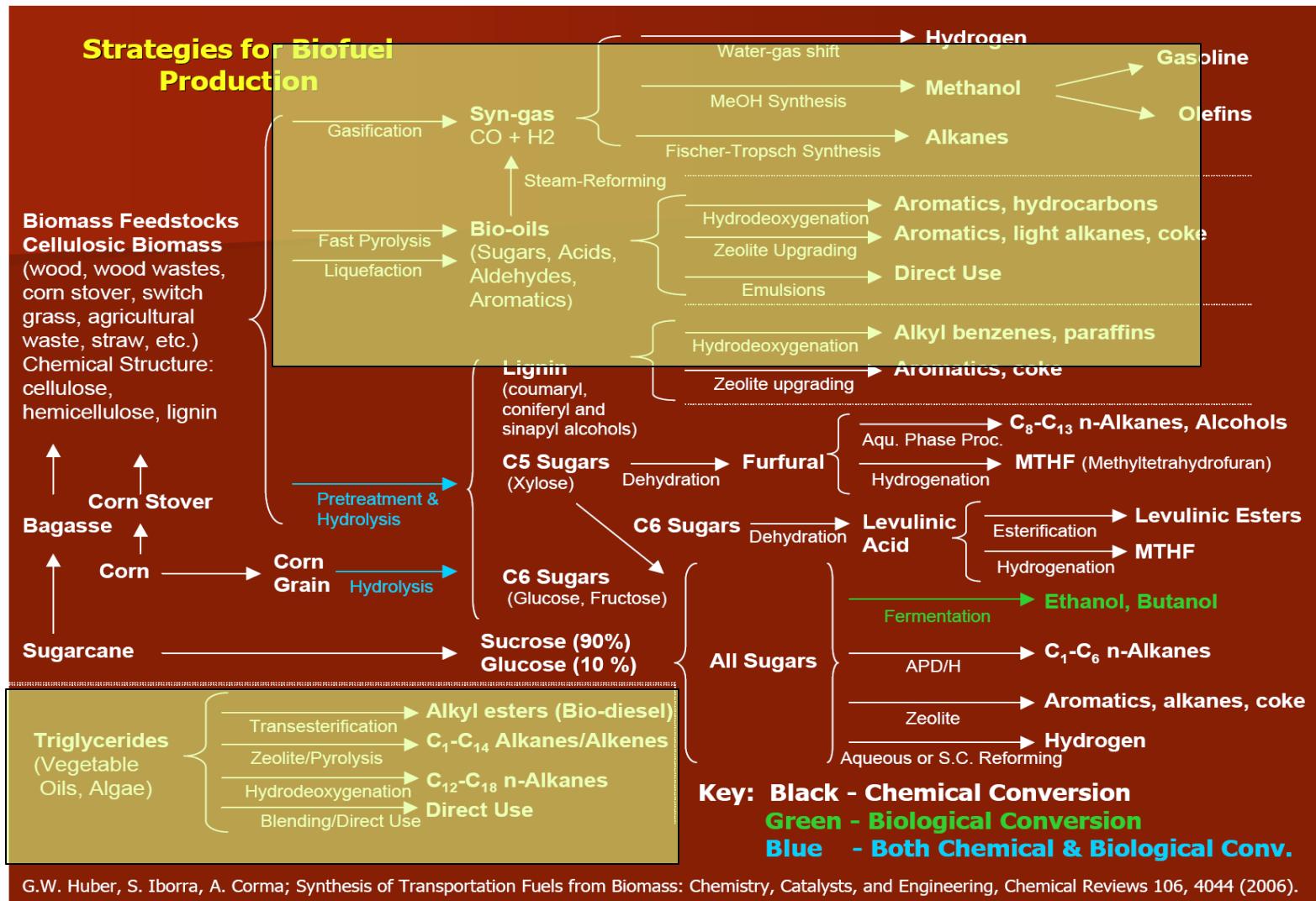


Aviation and Agriculture run on middle distillate fuels (Jet and Diesel)

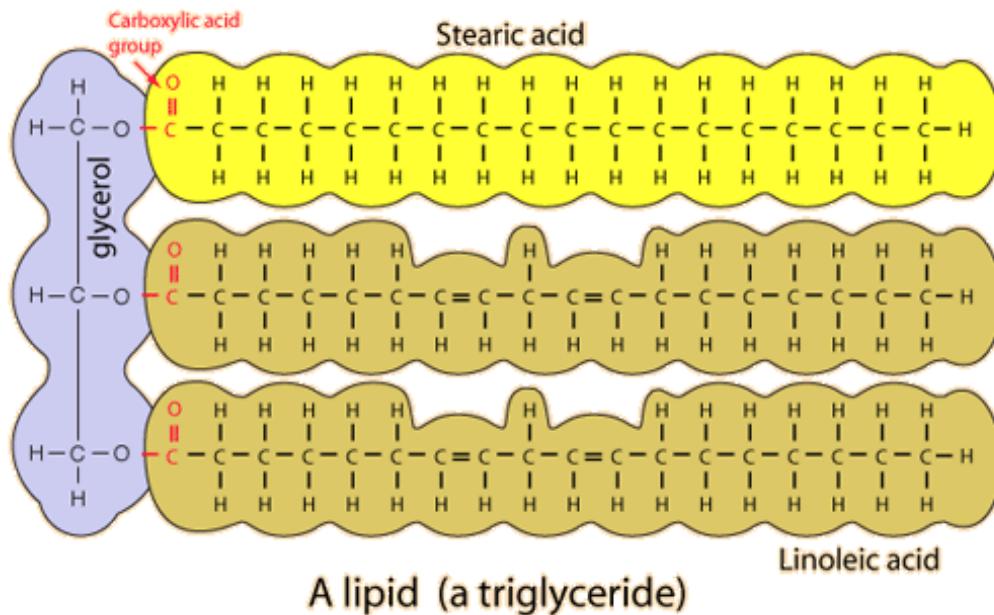
Two ways to make bio-based middle distillate fuels, two different challenges

Technology challenged

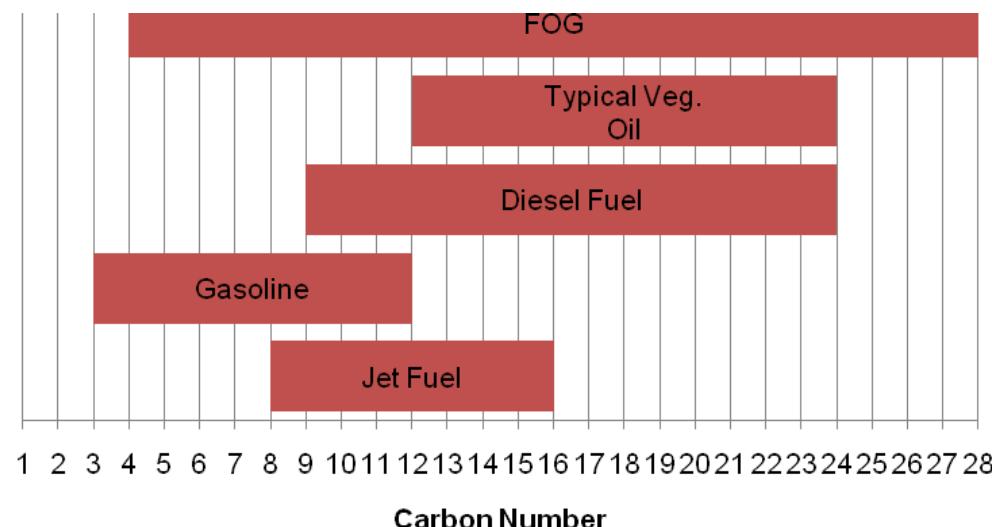
Feedstock challenged



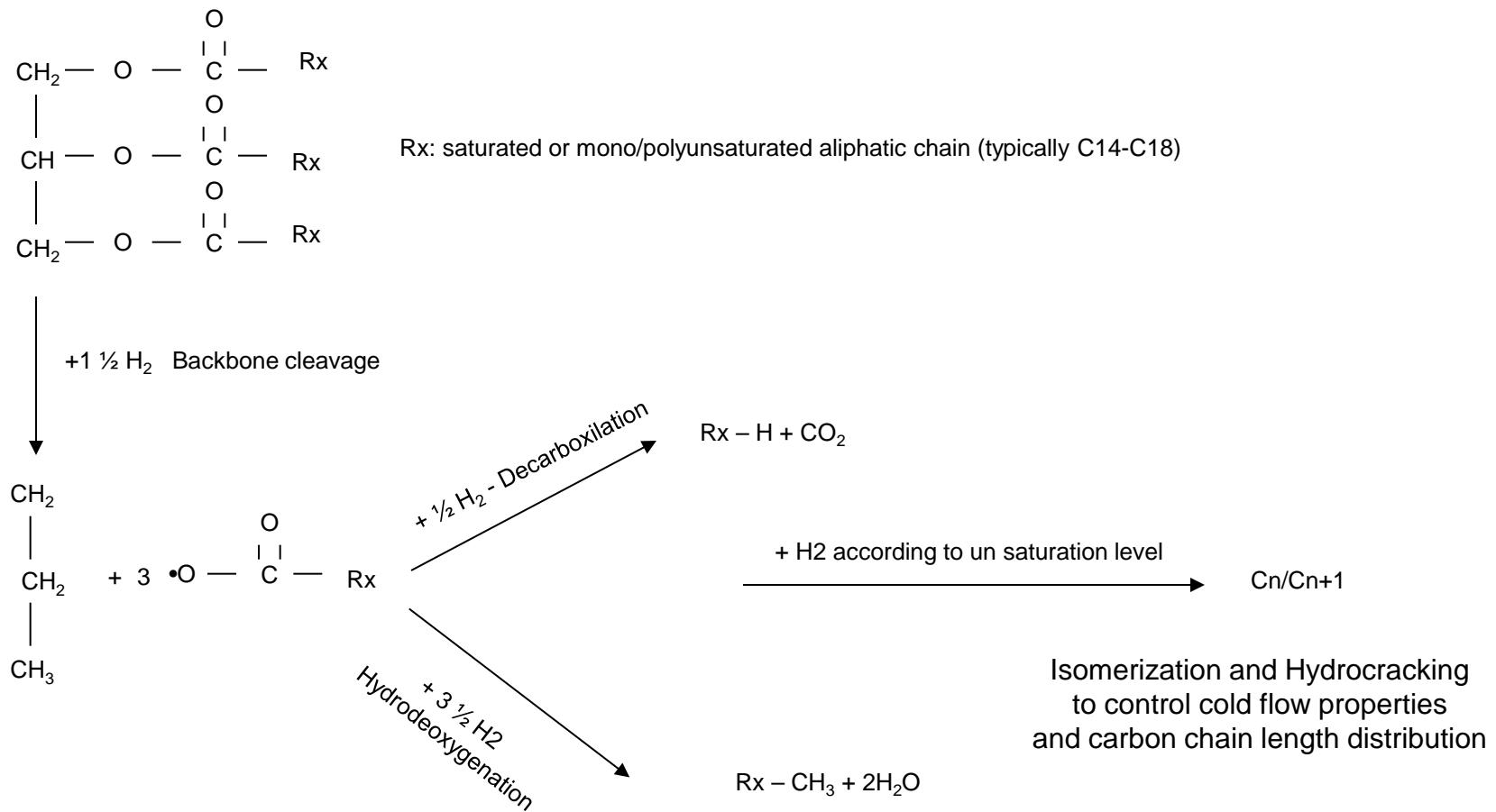
TAG structure and fuels. Perfect match with fuels



A lipid (a triglyceride)

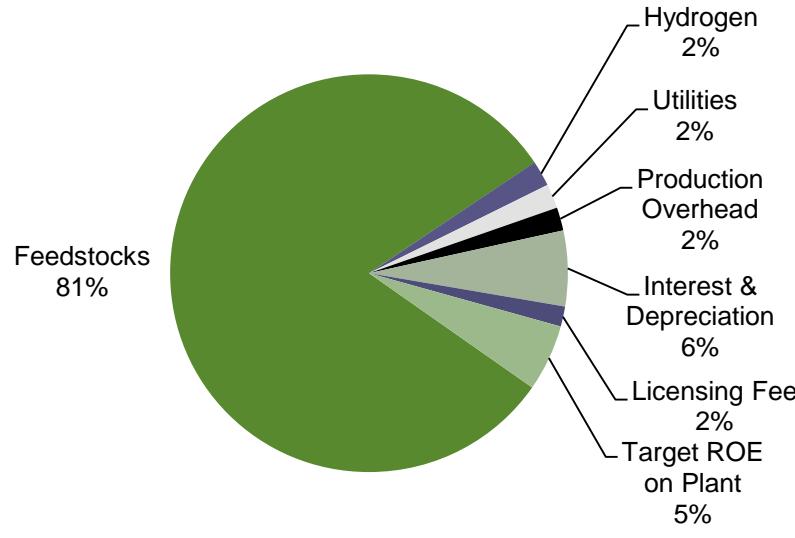


Hydrotreating of lipids over Ni/Mo catalysts; simple chemistry borrowed from the oil and gas industry



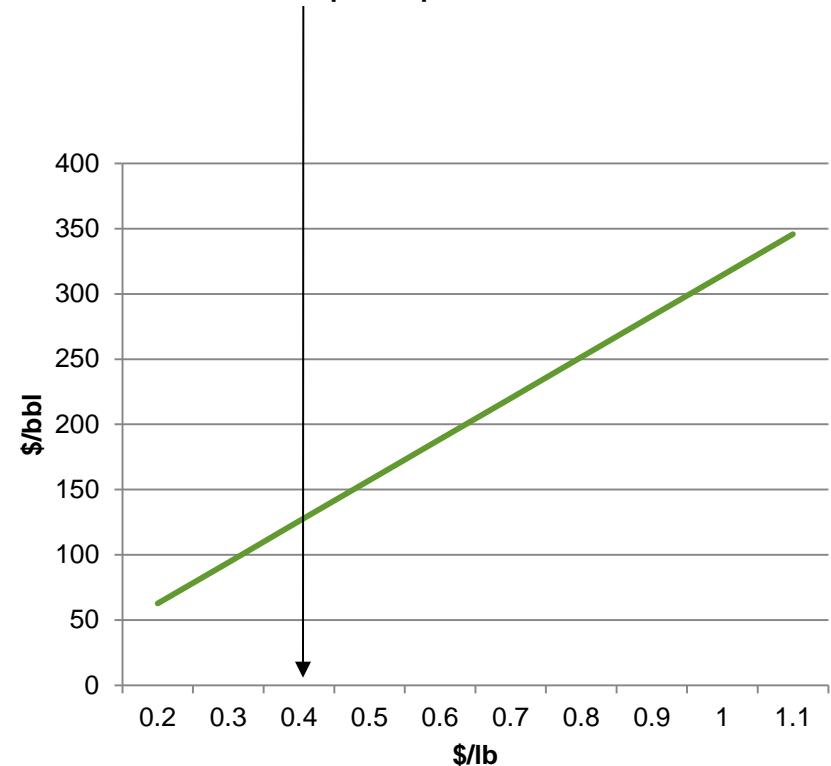
Renewable fuels cost structure. It is a feedstock game!

Production Costs per Gallon of renewable middle distillate fuel



We can compete on market price
but remain very sensitive to
agricultural commodity
sensitivity

Current crop oil price



Moving forward

- The technology is ready and very effective but to scale up significantly at commercial scale will need:
 - Feedstock development
 - Clear energy policies beyond blending mandates