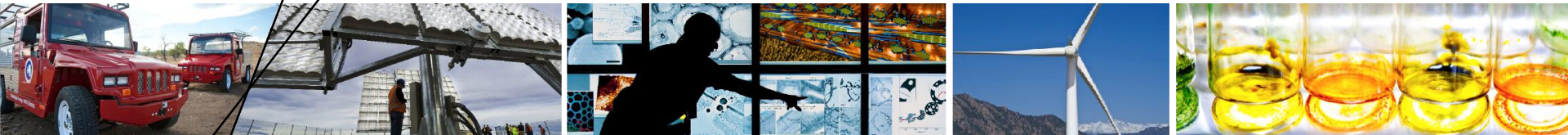


The Bioenergy Industry:

The importance of bioenergy in the short term, liquid biofuels and bioelectricity, Brazil and Latin America context

Dr. Thomas D. Foust



FAPESP-SCOPE

Bioenergy and Sustainability Project

Release of the Synthesis of Knowledge Volume

April 14th , 2015

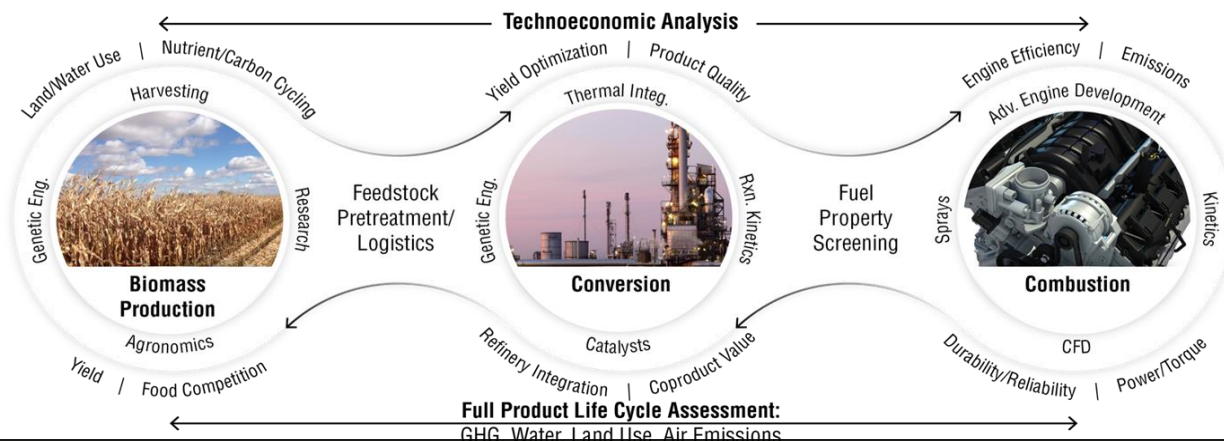
Importance of Bioenergy

- **80 to 90% of Human Development Index (HDI) achieved with 100 GJ year/person**
- **Bioenergy well suited to supply this amount of energy**
- **Challenge is not global supply but local supply and appropriate conversion technologies**
- **Challenges for bioenergy differ by region:**
 - Rural areas – distribution
 - Urban areas - cost

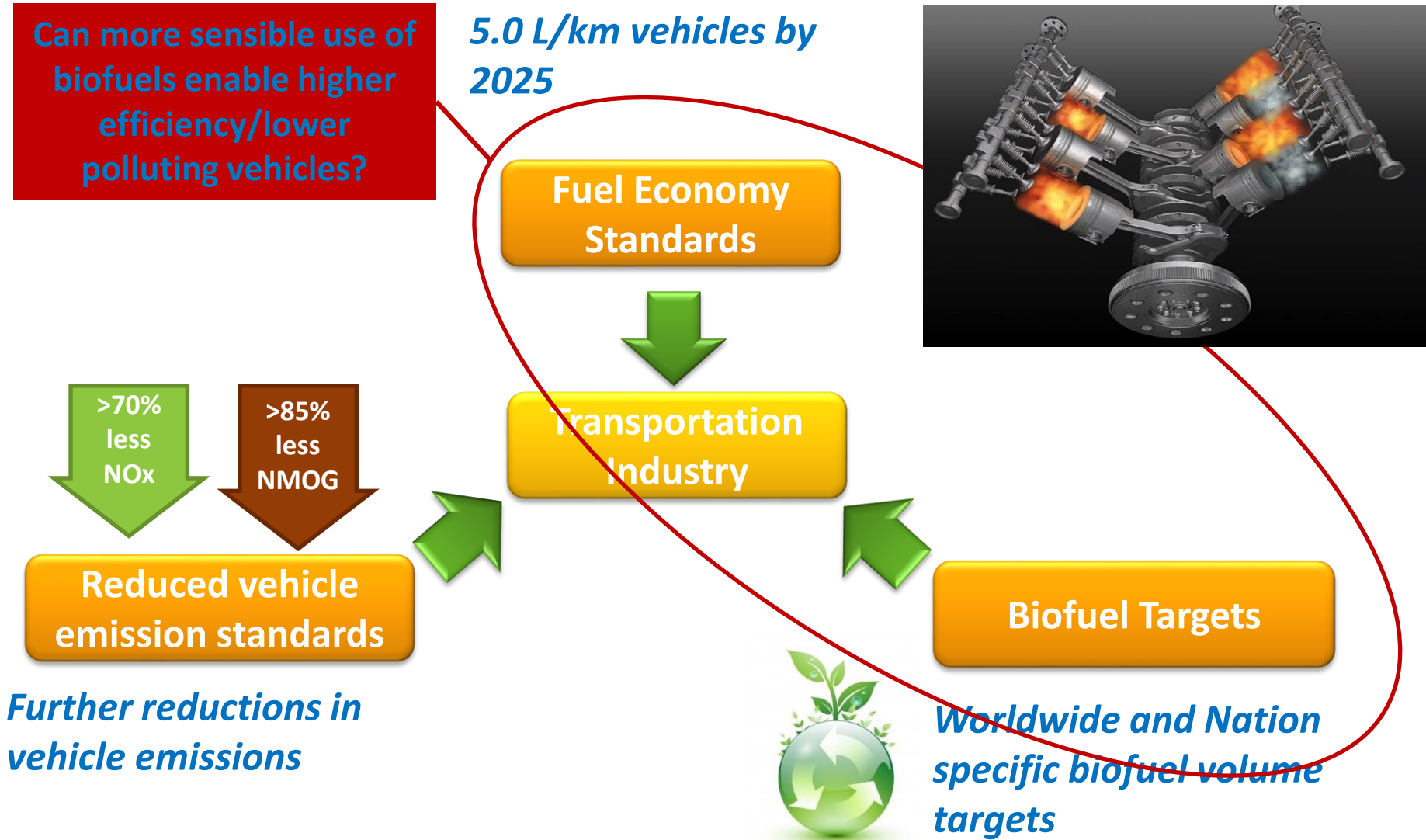


Biomass production and conversion matched with end use

Biomass Type	Conversion Technology	Science Needs
Low intensity forestry and agriculture	Space heating and cooking	Higher efficiency and lower pollution
Plantation forestry and high yield agriculture	Densification (pelletization) for electrical generation	Higher efficiency
Sugarcane	Pressing and fermentation to ethanol plus electrical generation	Higher yields and better power generation technologies
Oil Palm	Transterification and hydrotreating	Sustainable land management

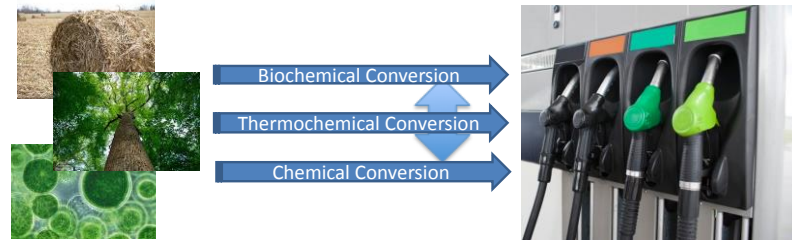


Can bioenergy/biofuels be better than traditional fuels?

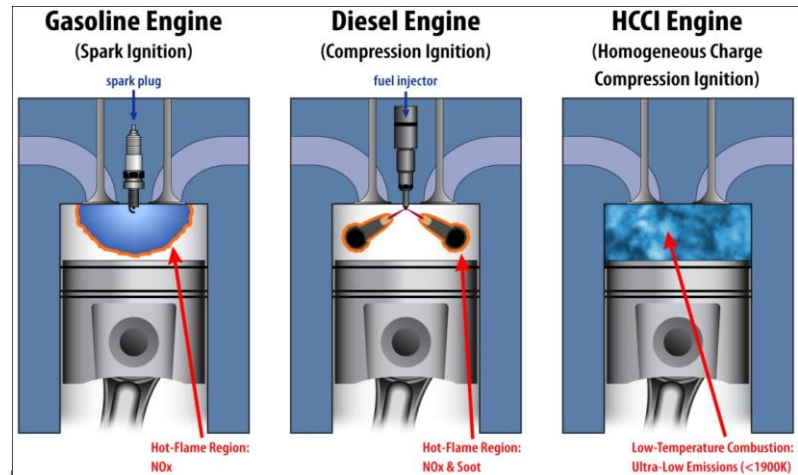


Jointly Optimize Biofuels and Internal Combustion Engines

Requires BILLION liter quantities and good materials compatibility



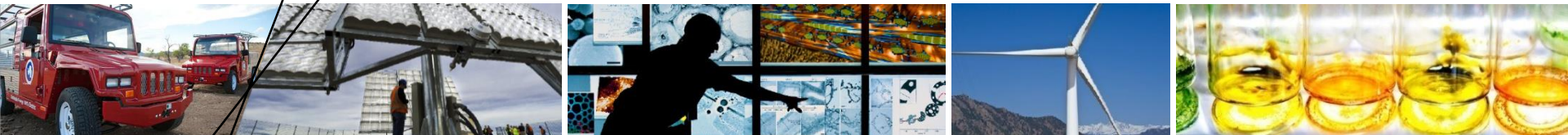
Technology advances are blurring the lines between conventional spark-ignition and compression-ignition engines



Potential efficiency improvements of 30 – 40% could enable cars with efficiency levels of < 4 L/km

Substantial improvements in engine efficiency are required to meet new fuel efficiency standards. Two approaches have strong potential.

- Shorter term (3 – 5 years): Renewable or renewable-blended Super Premium (RSP) gasoline for high-efficiency boosted spark-ignition (SI) engine: 15-20% improvement.
- Longer term (5 – 10 years): Dilute Low-Temperature Combustion (LTC) strategies utilizing kinetic controlled combustion: 30-40% improvement.



Thank You!