

Determining Markets in Volatile Conditions

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Chad Hart

Assistant Professor/Grain Markets Specialist

chart@iastate.edu

515-294-9911

Bio-based Market Opportunities

* Based on the value of the conventional product market

** Represents the growth rate of the product/sector, e.g., conventional gasoline, not the bio-sector growth rate

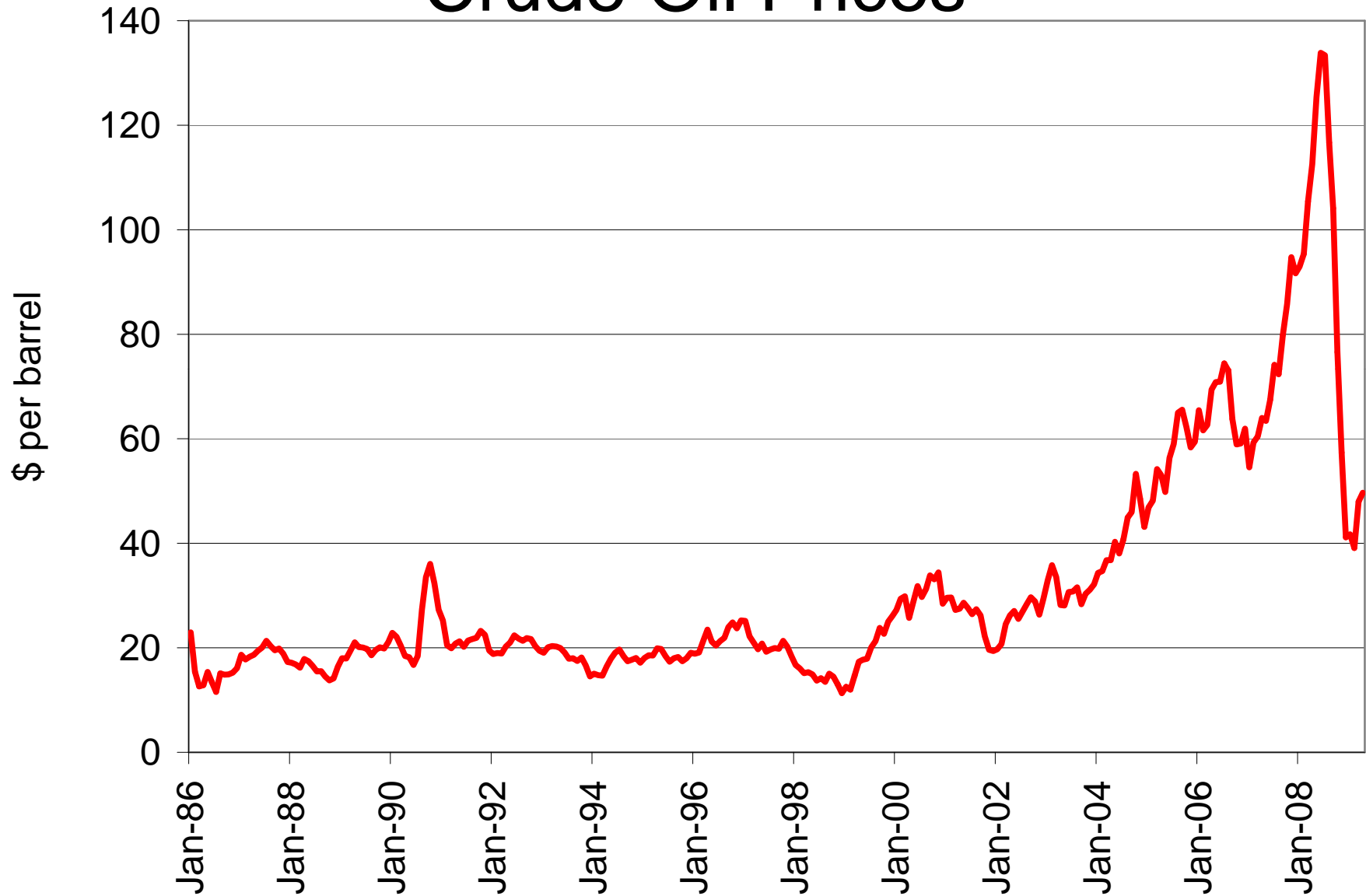
*** Represents the % share potential relative to the biobased economy

Rank	Product/Sector	Value \$*	Volume	Bio-Product Stage of Development	Conventional Market Rate of Growth**	Bio-Product Market Share by 2025***	
1	Gasoline (Ethanol)	\$230 billion \$6.7 billion	139 billion gal. 3.9 billion gal.				Well Established
2	Pharmaceutical	\$113 billion	na				Initial Commercialization
3	Diesel (Biodiesel)	\$110 billion \$840 million	62 billion gal. 306 million gal.				Early Development Stage
4	Clothing (Biopalstic Blends)	\$80 billion	na				Research/Conceptual Stage
5	Sanitary and Hand Cleaners	\$22.3 billion	na				Very Fast => GDP Growth +2%
6	Coatings	\$19.5 billion	1.6 billion gal.				Moderately Fast = GDP Growth +2%
7	Plastic Films	\$17.8 billion	na				Slow = Avg GDP Growth
8	Carpeting	\$14.4 billion	20.8 billion sq. feet				Flat = < GDP
9	Fertilizers	\$12.5 billion	na				Large
10	Containers	\$12.2 billion	13 billion lbs				Medium
							Small
							Niche/Specialty

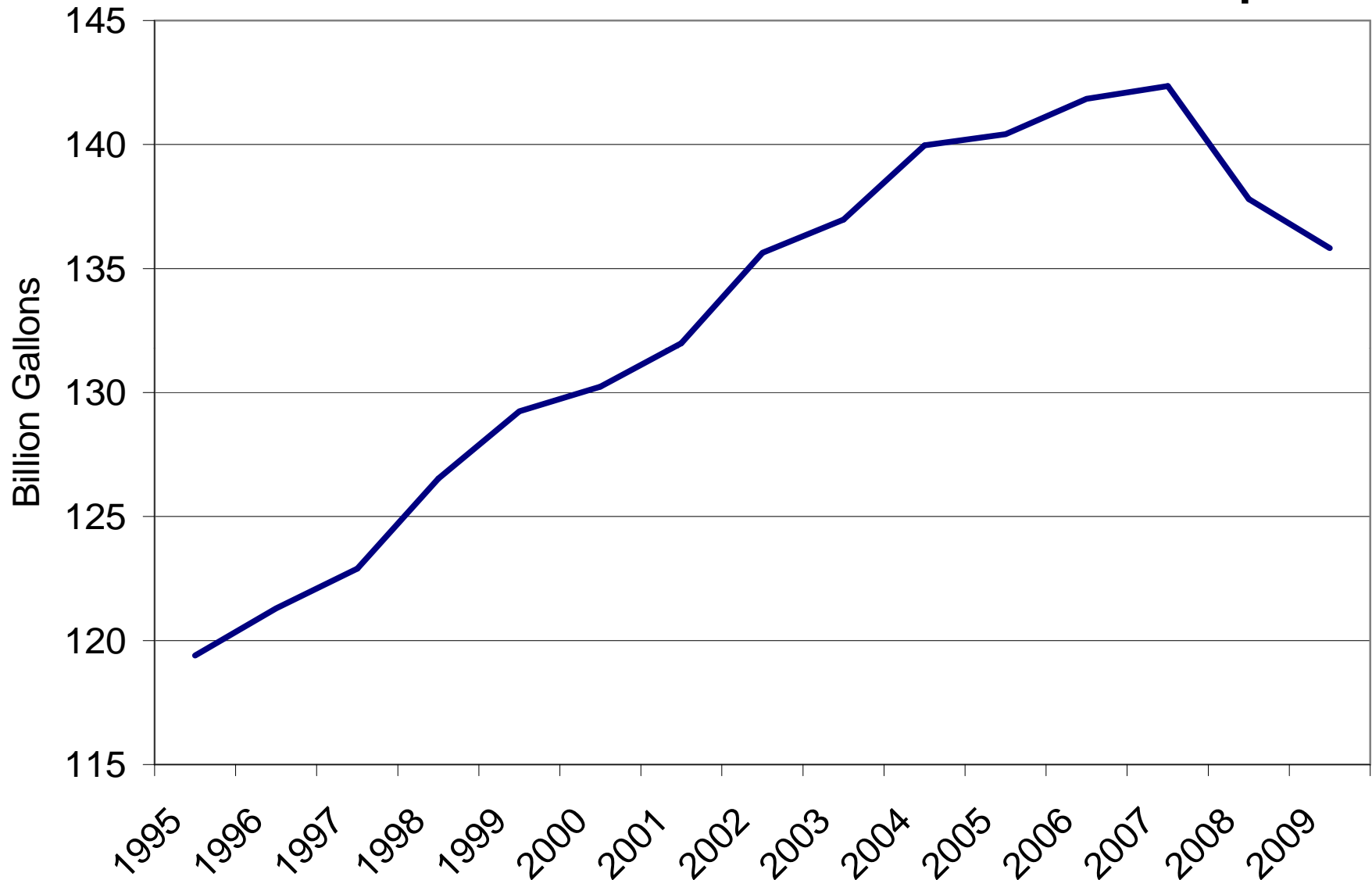
Liquid Fuel Usage

	2006	2010	2015	2020	2025	2030
	(Million Barrels Oil Equivalent per Day)	(Percent of 2006 Value)				
United States	20.7	95%	98%	98%	100%	105%
Canada	2.3	100%	100%	100%	104%	109%
Mexico	2.1	71%	81%	90%	95%	100%
Europe	15.7	92%	92%	95%	96%	96%
Japan	5.2	88%	92%	96%	92%	90%
China	7.2	118%	139%	168%	192%	213%
India	2.7	89%	115%	144%	159%	174%
Africa	3.0	117%	120%	123%	127%	130%
Central and South America	5.7	116%	116%	119%	125%	133%
World	85.0	102%	107%	113%	119%	125%

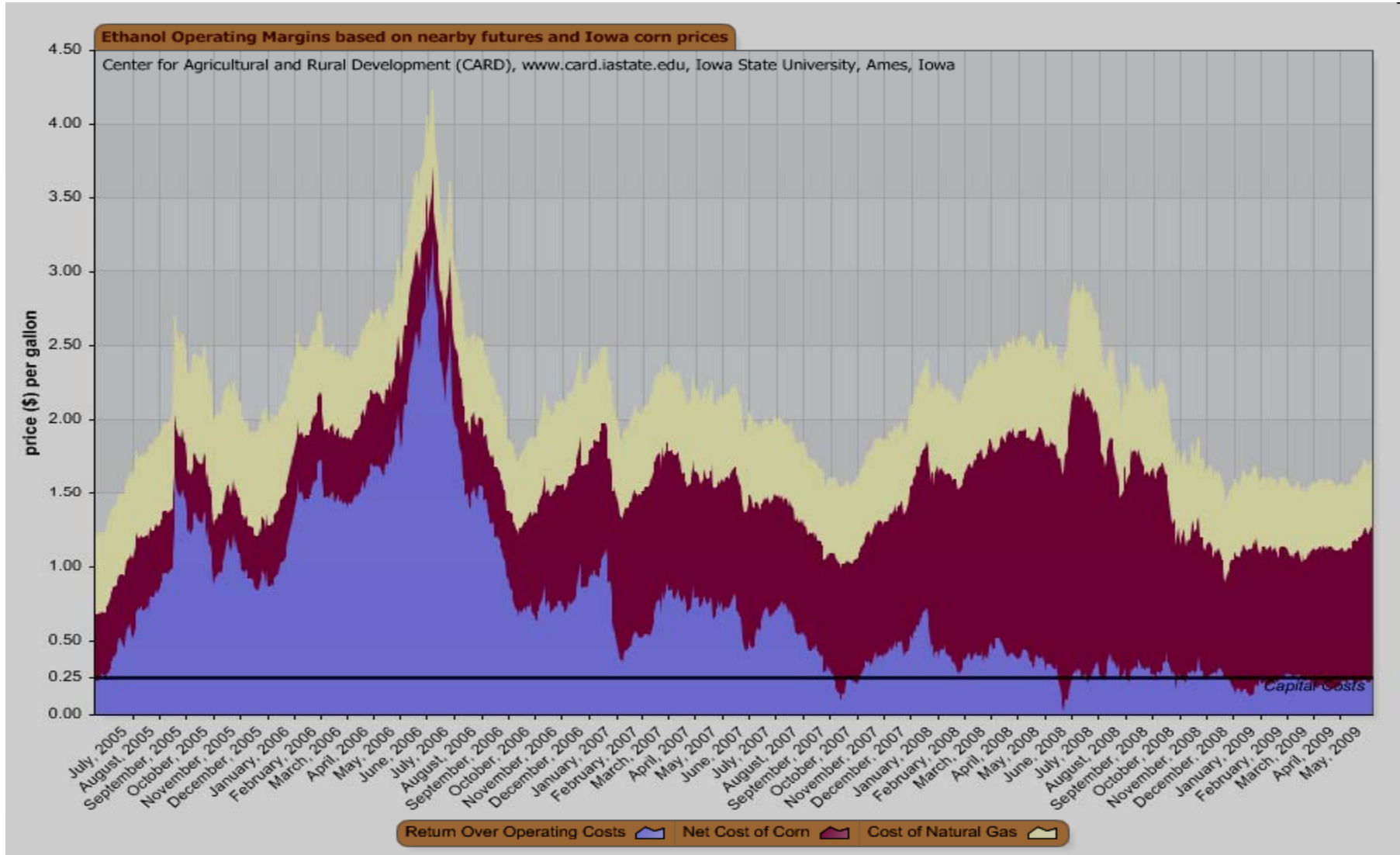
Crude Oil Prices



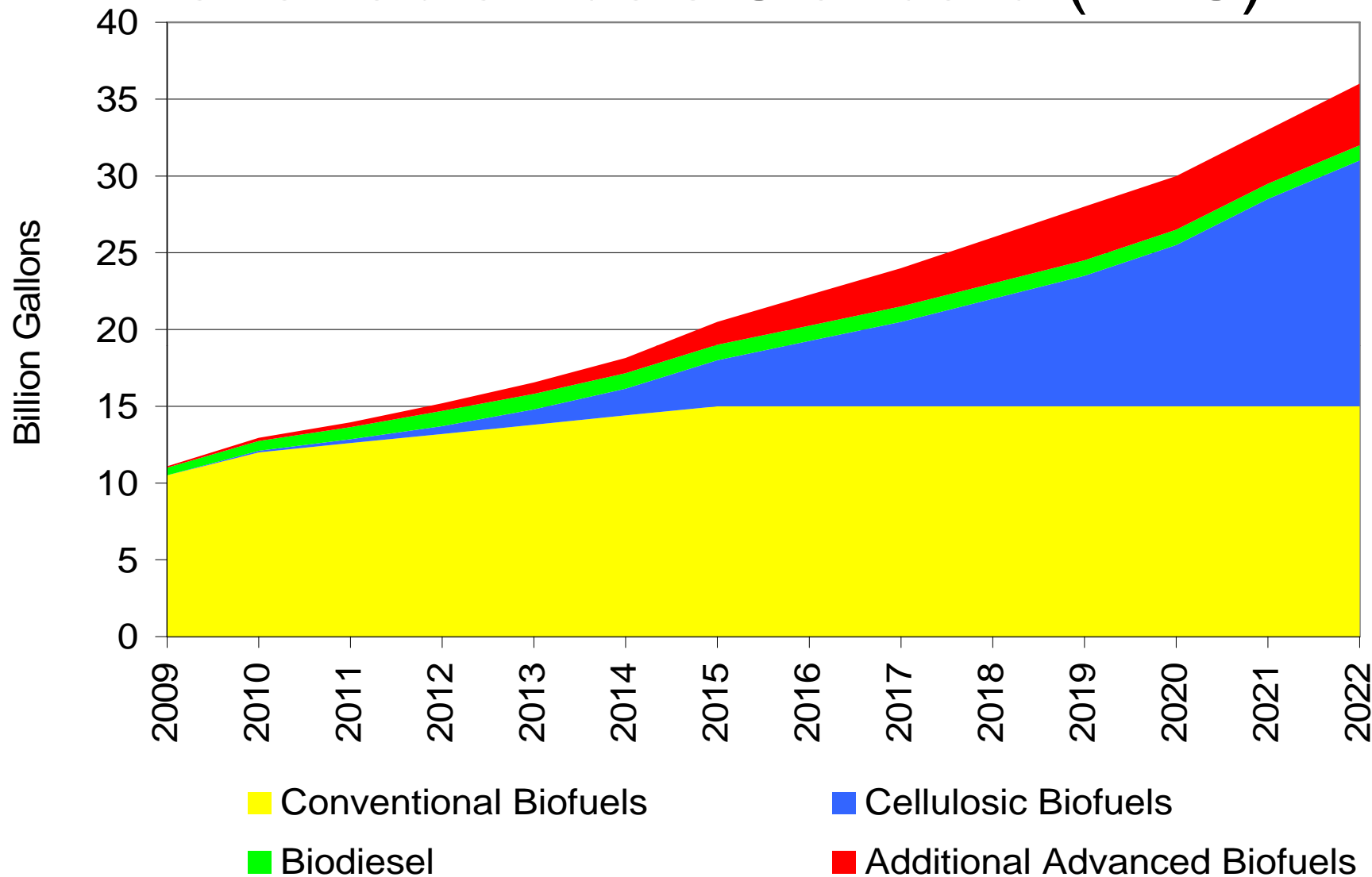
U.S. Blended Motor Gasoline Consumption



Ethanol Margins



Renewable Fuels Standard (RFS)



Spectrum of Biofuels

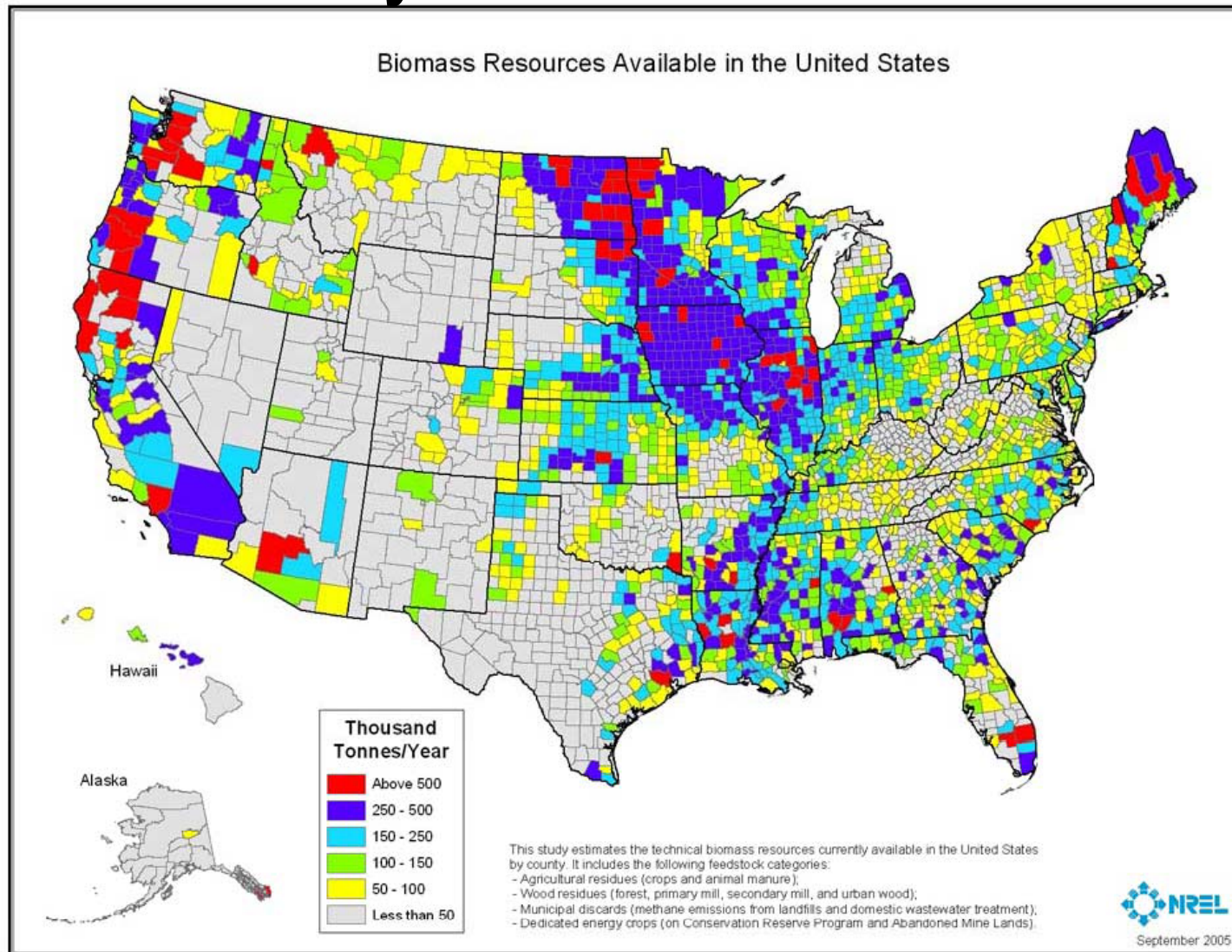
- Grain/Sugar Ethanol
- Biodiesel
- Green Gasoline/Diesel
- Cellulosic Ethanol
- Butanol
- Pyrolysis Liquids
- Syngas Liquids

Most Mature



Least Mature

Currently Available Biomass



Biofuel Challenges

- Production costs
 - Conversion, ag. production, etc.
- Infrastructure barriers
 - Developing supply chain for biomass
 - Continued development of biofuel distribution system
 - Growth in biofuel-compatible vehicles

Biofuel Challenges

- Investment risks
 - Higher capital costs, emerging technology
- Biomass production shifts
 - Inducing farmers to produce new crops
- Consumer understanding
 - About the fuels
 - About the tradeoffs

Thank you for your time!

Any questions?

My web site:

<http://www.econ.iastate.edu/faculty/hart/>