



U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**

Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable

U.S. Department of Energy Biomass Program

From the Field to End Use:

**Outcomes of the January 2007 DOE – ANSI
Workshop on Biofuels Standardization**



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**ANSI Biofuels Standards Panel (ANSI-BSP) Inaugural Meeting
Wednesday, May 9, 2007
Westin Arlington Gateway, Arlington, Virginia**

January 2007 Workshop Highlights

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Attendance:

- 52 Total attendees, representing 6 Federal agencies, 9 SDO/CDOs, and 6 from Industry.

Meeting Format:

- ½ day of presentations.
- 2 - ½ days of facilitated sessions.
- Facilitated sessions addressed barriers, and standards and codes in those topic areas.

Meeting Outputs

- Proceedings Document
- Standards Related Webforum
- Prioritized Barriers (in progress)
- Standards Development Activity Templates (in progress)

January 2007 Workshop Highlights

Needs Specific to this Panel

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ANSI Biofuels Panel should be developed to:

- Harmonize standards-setting activities
- Lead industry response on this matter because of the
 - SOTU
 - International competition/standards
 - International issues
- Provide timely response (3-6 month timeframe)
- Provide thorough gap analysis
- Ensure outreach to industry
- Challenges:
 - Identify experimental data needs
 - Identify various needs to move quickly
 - Ascertain if there are funding needs

Question -- Does an ASTM spec & weights and measure requirement eliminate these problems?

Barriers Categories Discussed

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Feedstock Production
(farm, forest, other)

Pretreatment / Preprocessing
(single- or multi-stage treatment; at farm, at plant, other)

Plant/Processing of Biofuel Commodities

Distribution of Biofuel Commodities

Vehicles, other end-products, & co-products

Federal and State Government Issues

Facilitated Sessions

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Feedstock Production
(farm, forest, other)

DAY 1
Facilitated Sessions

Pretreatment / Preprocessing
(single- or multi-stage treatment; at farm, at plant, other)

Plant/Processing of Biofuel Commodities

Distribution of Biofuel Commodities

DAY 2
Facilitated Sessions

Vehicles, other end-products, & co-products

Federal and State Government Issues

Discussion and Identification of Biofuel Commodities

Discussion of Specific Topical Areas

DAY 2
Facilitated Sessions

Biofuel Commodity Information Captured

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Biobutanol	Homogeneous $C_4H_{10}O$	Main component is homogeneous, but there can be contaminants and impurities.
Biomethanol	Homogeneous CH_3OH	
Ethanol	Homogeneous product that gets blended with gasoline C_2H_5OH	E-10 maximum blend currently allowed, co-mingling of blended and unblended fuel can effect Reid vapor pressures.
Hydrogen	Homogeneous H_2	Different purity levels exist. Refueling computer interface protocol in place.

Biofuel Commodity Information – Cont.

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Biodiesel (Trademarked Fuel)	Non-homogeneous mixture	Diesel equivalent processed fuel derived from biological sources, which can be used in blends in unmodified diesel engines. If registered, it meets ASTM D-975
Green Diesel (E Diesel)	Non-homogeneous mixture	Fuel made from biomass-derived carbohydrates
Green Gasoline (Renewable Gasoline)	Non-homogeneous mixture	Gasoline-like fuel produced entirely from biomass
Renewable Diesel	Non-homogeneous mixture	Diesel replacement of high-quality fuel made from virgin or used vegetable oils or animal fats. If registered, it meets ASTM D-975

EU Defined Biofuel Commodities

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Bioethanol

Biodiesel

Biogas

Biomethanol

Biodimethylether

Bio-ETBE (ETBE produced on the basis of bioethanol)

Bio-MTBE (methyl-tertio-butyl-ether produced on the
basis of biomethanol),

Synthetic biofuels

Biohydrogen

Pure vegetable oil

Biofuel Commodities

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Priority Issues:

There is an apparent lack of common nomenclature and/or specifications for biofuel commodities.

Participants were not certain which fuels are included in, or applicable to the existing standards.

Technical definitions and performance characteristics and other information is needed for each fuel of the biofuel commodity entering the market (for example some standards are based on the potential for boil-over, but this information probably does not exist for these commodities).

There exists biodiesel stability issues. These stability issues may also apply to other biofuels.

Potential Biofuel Implementation Barriers

Identified in the Biofuel Vision Workshops Modified by DOE -- ANSI Workshop Participants

Feedstock (farm, forest, other)	Pretreatment	Plant/Processing	Distribution	Vehicles, other end-products & co-products.	Federal and State Government Issues
Feedstock production efficiency - Single pass harvest - Multi-pass harvest	Pretreatment/ Preprocessing (at farm or at the plant)	Exact processes need to be defined	Equipment Standards (rail, truck, barge, pipelines)	Dispensing related standards	Crop development issues. Most programs are state-based (this is a potential regulatory and deployment barrier).
GMO Acceptance by the general public	Environmental Issues	Fire Hazard concerns	Moisture content	Environmental considerations (tailpipe emissions, evaporative emissions)	Farm related regulations (state and Federal)
GMO standards to: grow, harvest, and utilize for fuel.		Depot concept - specifics on the concept need to be clarified. - no appropriate Stds exist.	Materials compatibility Issue	Insufficient infrastructure (new equipment and retrofit equipment issues)	Stakeholder education - decision makers - farmers - consumers
Utilization of large quantities of underutilized wastes.		Air Emission Standards	Ethanol Fuel and Blend Standards	Mismatch Issues (emissions, regulations, and intended fuel usage).	Interstate transport issues: - truck load limits - Invasive plant species
Development of performance based standards for feedstocks		Production Facility Classifications (EPA Rule - making)	Transfer & Distribution safety issues unknown	Fuel economy and emission data on biofuels is not available.	International harmonization of biofuel codes and standards
Harvesting Issues and Standards (relating to noise, fire, particulates, etc.)		Water Use (plant processes)	Transfer & Distribution fuel blend quality Issues	Consideration of biofuels as a future h/hydrogen energy carrier.	Legal Issues including preemption; displacing effect that federal law will have on a conflicting or inconsistent state law.
Lack of appropriate farm policies for biomass energy crops			mix spill containment & recovery procedures.		International land issues, including deforestation.
Feedstock storage issues (at farm or at plant).					Climate change issues (GHG emissions, CO2 cycle and recycle, treaties and agreements).
Development or modifications to harvesting equipment standards.					International Industrial competitiveness

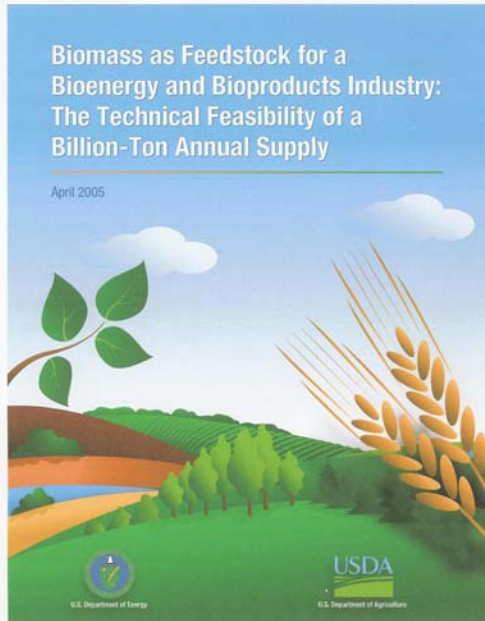
Review of Barriers; Feedstocks

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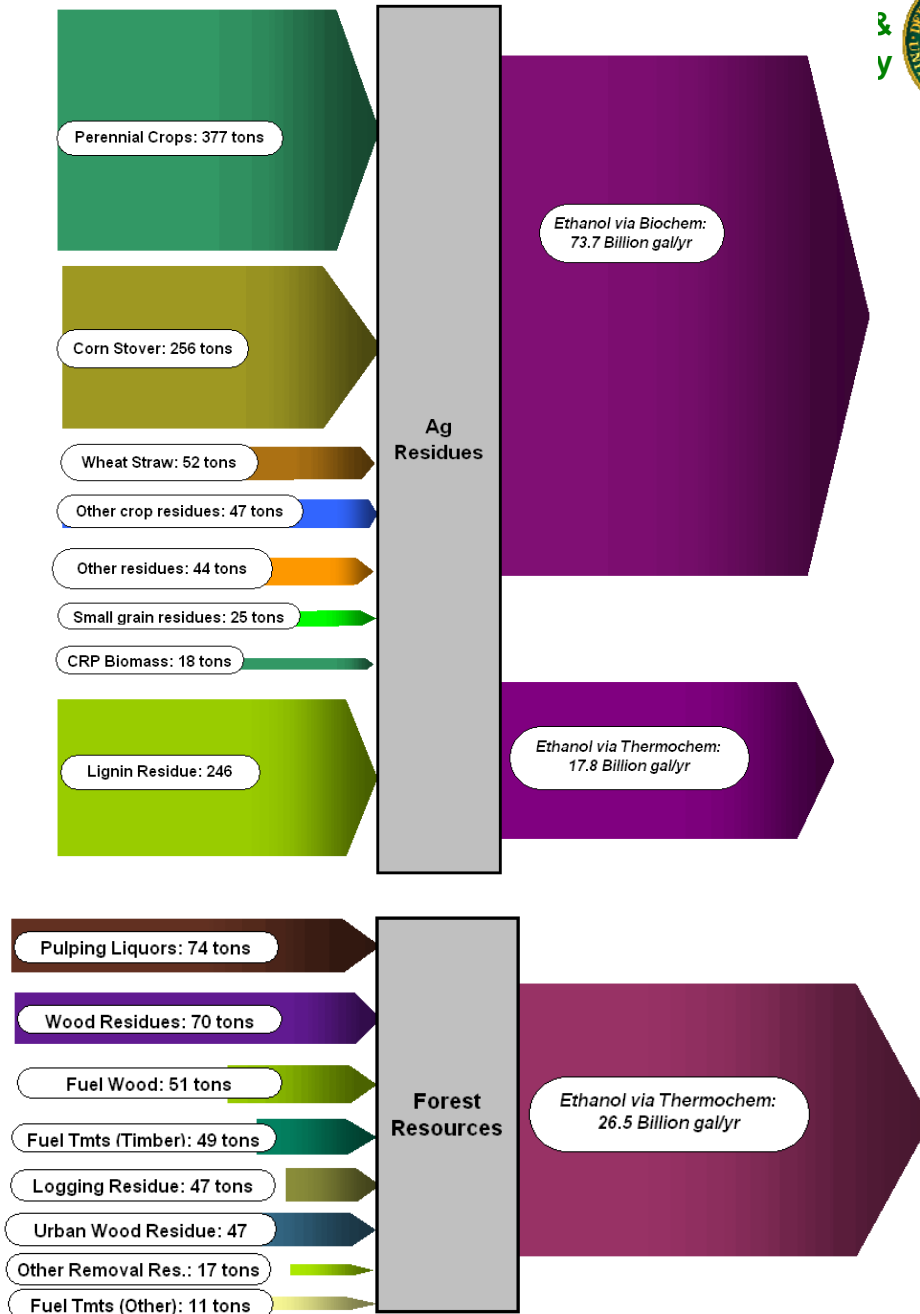


- Feedstock production efficiency; Single pass -vs- multi-pass harvest
- GMO Acceptance; GMO standards to: grow, harvest, and use fuel.
- Utilization of large quantities of underutilized wastes.
- Development of performance based standards for feedstocks
- Harvesting Issues and Standards (relating to noise, fire, particulates, etc.)
- Lack of appropriate farm policies for biomass energy crops
- Feedstock storage issues (at farm or at plant).
- Development or modifications to harvesting equipment standards.
- Feedstock bulk density (as received or bone dry basis).
- Food -vs- Fuel issues. Can be expressed as starch -vs- protein issue.
(Should standards or percentages set to ensure production of food supplies?)
- Soil Biodiversity issues.
- Monocultured grasses, etc.
- Farm land conversion to residential and commercial use.
- Issues associated with reduced resource base.
- Crop yields/acre

Conversion of Available Feedstocks



- “Billion Ton” study indicates that enough biomass is potentially available to displace > 30% of current U.S. petroleum consumption
- But it requires variety of biomass types
 - Agricultural lands
 - Corn stover, wheat straw, soybean residue, manure, switchgrass, poplar/willow energy crops, etc.
 - Forest lands
 - Forest thinnings, fuelwoods, logging residues, wood processing and paper mill residues, urban wood wastes, etc.



Review of Barriers; PreTreatment

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- Pretreatment/ Preprocessing (at farm, plant, or other)
- Single-stage or Multi-stage Pretreatment
- Hazardous Material Transport Issues
- Environmental Issues

Review of Barriers; Plant/Processing

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- Exact plant processes need to be defined (these may be commodity specific processes)
- Fire Hazard concerns
- Depot concept
 - specifics on the concept need to be clarified.
 - no appropriate Standards exist.
- Air Emission Standards
- Production Facility Classifications (EPA Rule - making)
- Water Use (plant processes)

Review of Barriers; Distribution

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- Equipment Standards (rail, truck, barge, pipelines).
- Moisture content of fuels.
- Materials compatibility issue .
- Ethanol Fuel and Blend Standards.
- Biodiesel Fuel and Blend Standards.
- Transfer & Distribution safety issues unknown.
- Transfer & Distribution fuel blend quality issues.
- Mix spill containment & recovery procedures.
- Biofuel fire suppression protocol

Review of Barriers; Vehicles, other end-products & co-products

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- Dispensing related standards.
- Environmental considerations (tailpipe emissions, evaporative emissions).
- insufficient infrastructure (new equipment and retrofit equipment issues).
- Mismatch issues (emissions, regulations, and intended fuel usage).
- Fuel economy and emission data on biofuels is not available.
- Consideration of biofuels as a future hydrogen energy carrier.

Review of Barriers; Federal and State Government Issues

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- Crop development issues are mostly state-based Programs
 - this is offers potential regulatory and deployment barriers
- Farm related regulations are both State and Federal
- Stakeholder education necessary:
 - decision makers
 - farmers
 - consumers
- Interstate transport issues:
 - truck load limits
 - invasive plant species
- International harmonization of biofuel codes and standards
- Legal issues including preemption; displacing effect that federal law will have on a conflicting or inconsistent state law.
- International land issues, including deforestation.
- Climate change issues (GHG, CO2 cycle and recycle, treaties and agreements).
- International industrial competitiveness

Workshop Outputs;

Feedstock Production

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	Standards/Codes	Status	Lead Organization	Supporting Activities or Issues
Production of Feedstocks	Develop procedure to define feedstock composition (dependent on processing options)	Does not exist	ASABE	Future market parameters
	Feedstock impact on final products (traces, GMO in DDGs, etc)	Example: d245.5 - moisture content	ASABE	
	Development of measurement standards and certified reference materials for both GMO/Non-GMO	Does not exist		
	Some reference materials does exist for the biomass feedstocks but it is not comprehensive. (USDA, National Labs)	NIST w/ Industry		Need to define all biofuel feedstocks and develop comprehensive database of information.
	Test method (private industry)	Reference materials (NIST)		
	Review existing standards	Develop analysis tools that could be certified against the standard		
	Best Practices (Sustainable Farming/Forest Standard)	ISO 14000/Env. Mgmt Some parts exist	USDA (ASABE), DOI, USDA (FS)	Review existing practices work to development vol. standards

Workshop Outputs;

Feedstock Harvest and Collection

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Standards/Codes	Status	Lead Organization	Supporting Activities or Issues	Time to completion
Harvesting/ Collection				
ISO 22006: Application of ISO 9001 to Production Ag.	What about mature energy feedstock (back with potential to GMO for protein issues) based co-production			
Differentiate GMO and traditional crops	Committee Draft; work comments	USDA, ASABE, AOCS		
	Energy crops over take ag land. Resolve concerns about GMO			
FDA (check fed regs)	Harvest Equipment standards			
Cab filter standards	Sensors on equipment			
Combine cleanout: GMO/non-GMO	Some parts exist lots of work done Various testing protocols Dust fires are big issues			
Review Existing equip. standards.	Catalytic converters on outdoor power equipment (EPA)	Major equip manufacturers, SAE AEM FEMA (farm equip.)	Air Quality Issues	
Particulates and Odors	Standardization of harvesting energy crops for new processes	Some exist at the federal and state level; many state exempt, but new standards on the way	Modeling? Monitoring-not local	
State and local dust and odor issues	Possible need for mitigation strategies			
Need to understand the Chemical composition of the biomass materials	EPA (NACAA, ASABE, States)			
ASTM (E48, E56)	Tag TC 229, NNI			

Workshop Outputs;

Feedstock, Dry Material Storage

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	Standards/Codes	Status	Lead Organization	Supporting Activities or Issues
Storage-Dry Storage (on farm or plant)	NFPA 69, NFPA 654, NFPA 499, NFPA 61 (A.6.2.1), NFPA 1, NFPA 70, NFPA 86 ICC codes would also apply Assess Existing Practices	NFPA and ICC Fire Codes exist, but will need modification; large storage Silage tubes	NFPA, ICC	* Mitigate loose fibers * Flow properties * Crop pretreatment standards, drying others
	Rodent infestation (regulation)	EPA, Chemical Safety Board, FPA, ASABE, ICC		

Workshop Outputs:

Needs in Specific Topical Areas

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Technology Definitions	Establish similar understanding	Consumer issues	Technical issues	Identify appropriate performance spec	Analysis and Testing	EPAct Fuels Harmonization requirement	ANSI/HLS panel model to issue standards
ASTM standard D. 975 (no current measurement of biofuels)	for biofuels that we have for petro (by fuel type)	who determines what/when goes in?	everywhere	non existent for biofuels	Life cycle analysis (energy balance) - need for a standardized approach	doe (policy) EPA (policy and air offices)	ANSI - establish biofuel standards panel
inclusive specifications standards codes (fire safety, health and environmental - consequences of looking at them separately)	determine progress of state and local standard work	terminal operators	effort to understand biofuel impact on vehicles (by feed)	supporting activities/analysis	Engine Testing - biodiesel test just started - some test info may exist that can be used as a starting point	DOE analysis - stability of fuel market	proposal because of the - SOTU - international competition/standards - international issues
need to define properties for standard biodiesel control application/ performance of product	develop blend standards	supply chain nodes	respective emission issues	ASTM -factor in up front -funding needed		implication of fuel quality	timely response is needed (3-6 months for kickoff)
OR determine which additives would counter differences in performance (weather, feed, etc)	new to review burn characteristics of fuels and apply appropriate suppressants	consider quality impacts thru supply chain (detreated/blending)	not just vehicles			SOW/draft is posted to the EPA website	ANSI model - 100's of organizations involved
biofuel definition in energy bill 2005		big ramifications to end users	pressurized hydrogen tanks - different from the fuel tanks issues			the report is based on the previous targets (before the 07 SOTU - 35 b gallons target)	GAP Analysis
cellulosics are renewable ---- no need for external energy		consumer has no clue as to the feed/fuel variation variation of % of biodiesel in blend					out reach to industry
		dispenser issues (H2, others, all different)					does an atm spec & weights and measure requirement eliminate these problems? Challenges: - identify experimental data needs - identify various needs to move quickly - is there a funding need?



On-going Activities

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- Prioritization of Barriers, and development of a strategic approach for addressing barriers in a timely manner.
- First Draft of National and International Standards Development Templates.
- Development of “Best Practices” for Ethanol Infrastructure
 - Prepare handbook describing current industry practices and regulations
- Bulk Storage and Dispensing Station Design and Develop

For Further Information

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U.S. Presidential Commitment to Ambitious Biofuels Goals

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- Cost-competitive cellulosic ethanol” by 2012
- **“20 in 10”**
 - Reduce U.S. gasoline* use by **20%** by 2017 through...
 - o **15%** reduction from new Alternative Fuels Standard at **35 billion** gallons/year
 - o **5%** reduction from enhanced efficiency standards (CAFÉ)
- **“30 in 30”**
 - Longer-term DOE biofuels goal
 - Ramp up the production of biofuels to **60 billion** gallons
 - Displace **30%** of U.S. gasoline consumption* by 2030

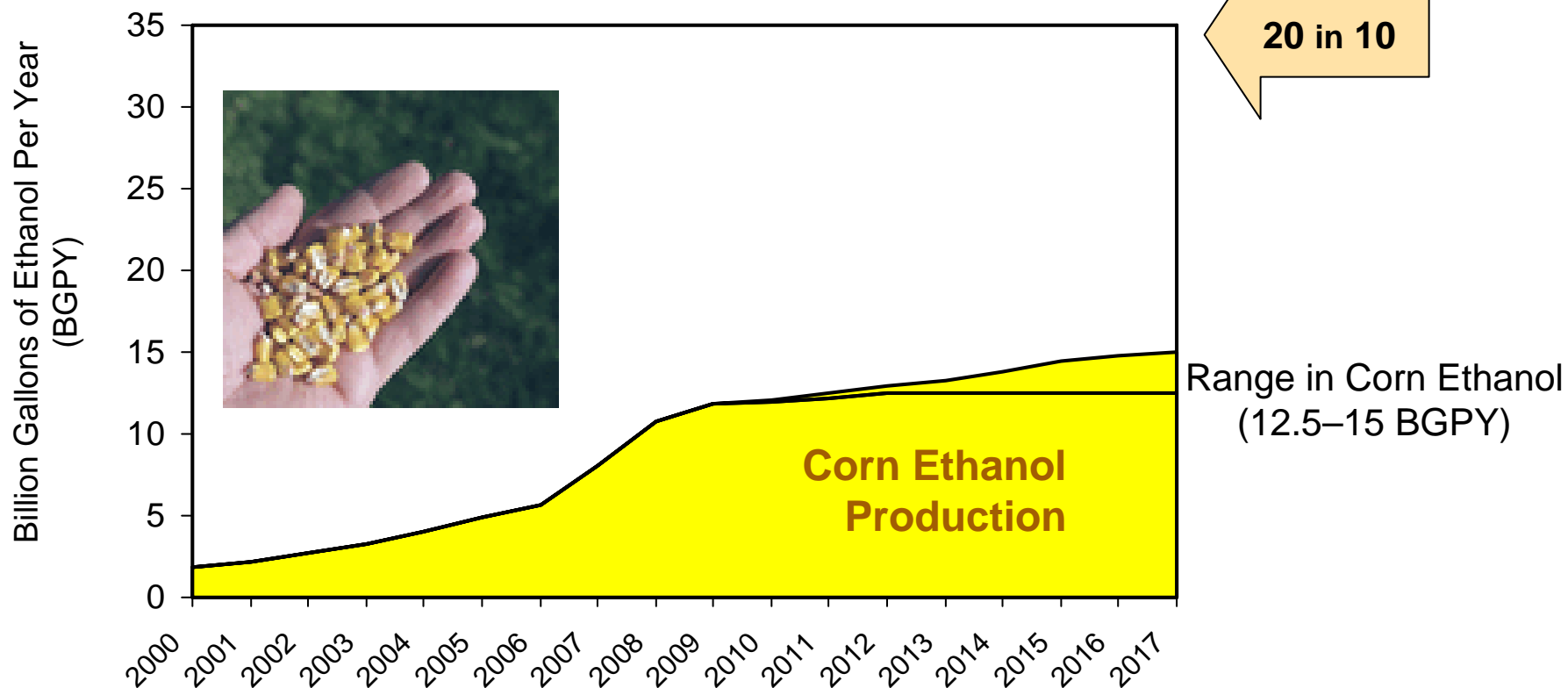
* light-duty vehicles only

20-in-10 Market Goal

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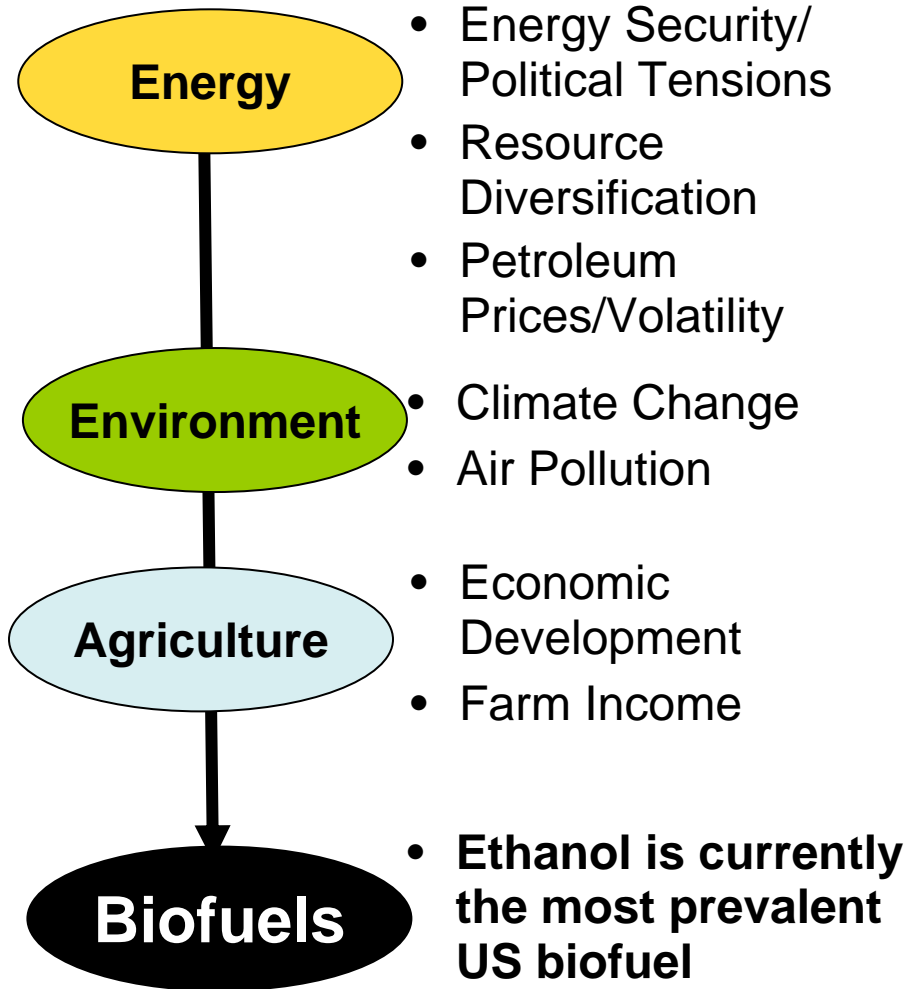


Potential Growth in U.S. Starch Ethanol Production Capacity



Corn ethanol will contribute substantially to the 20-in-10 market goal – but an incremental 20 billion gallons per year will be needed.

Policy Drivers & Incentives Supporting Biofuels



Examples of Policies

United States

- Energy Policy Act of 2005 (federal policy)
- State tax credits, blend requirements...

Europe

- Tax credits: most common incentive
- EU set target for biofuels consumption (similar to RFS, but not a mandate)

Asia

- China, India, and Malaysia introducing policies to support biofuels
- Japan has tax credits in place

South America

- Brazil: Ethanol blending requirements in place and a requirement for biodiesel starting in 2008