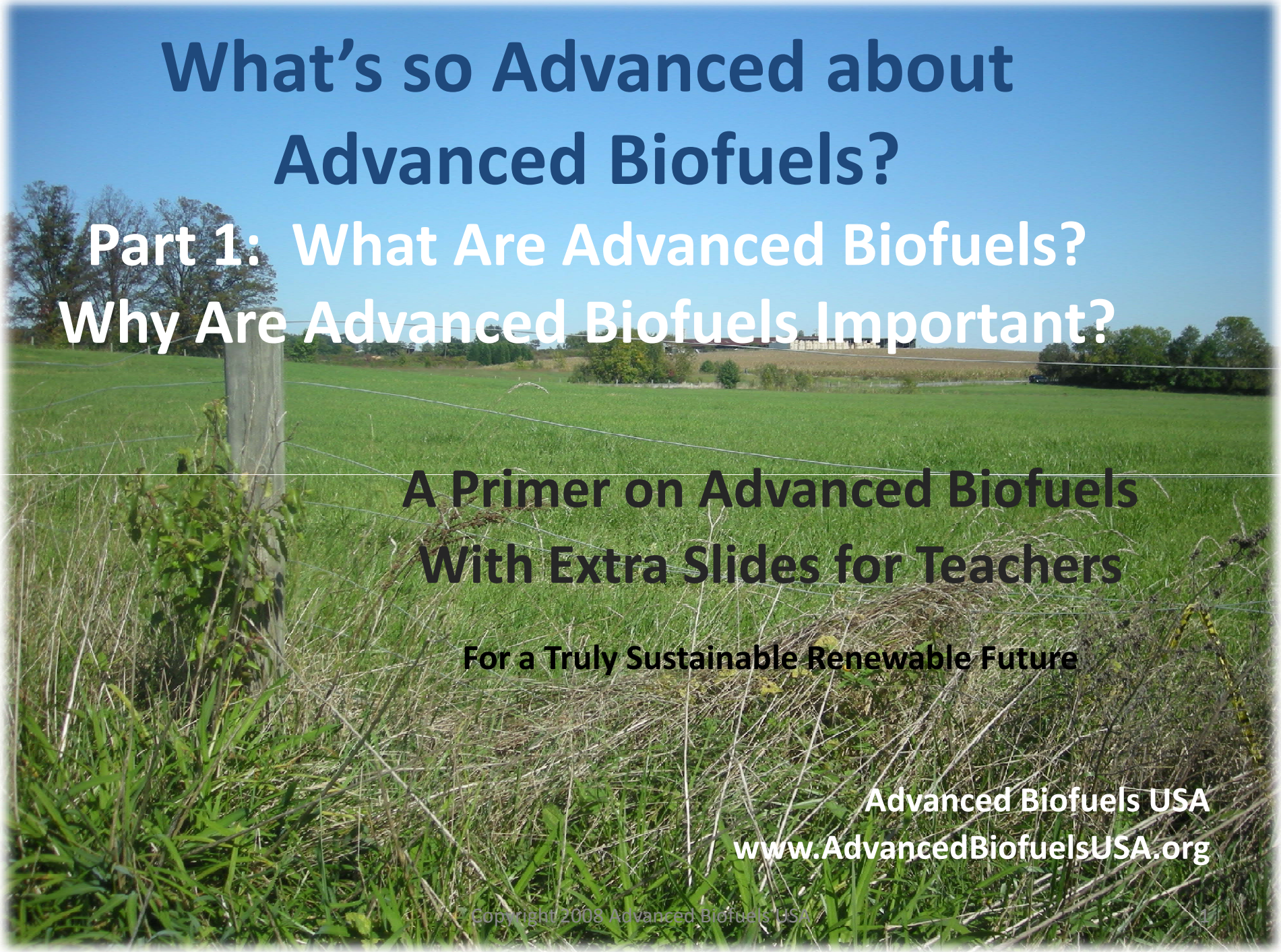


What's so Advanced about Advanced Biofuels?

Part 1: What Are Advanced Biofuels? Why Are Advanced Biofuels Important?

A Primer on Advanced Biofuels With Extra Slides for Teachers

For a Truly Sustainable Renewable Future

Advanced Biofuels USA

www.AdvancedBiofuelsUSA.org

Extra Slides with "Answers"

- This teaching tool complements "What's so Advanced about Advanced Biofuels," a slide presentation about creating sustainable, low-input, high energy output renewable liquid fuels.
- It includes, after the presentations, slides with
  - Questions and thoughts about the presentation
  - Class projects adaptable to all ages
  - Advanced class research suggestions

What Are Advanced Biofuels?

Why are they important?

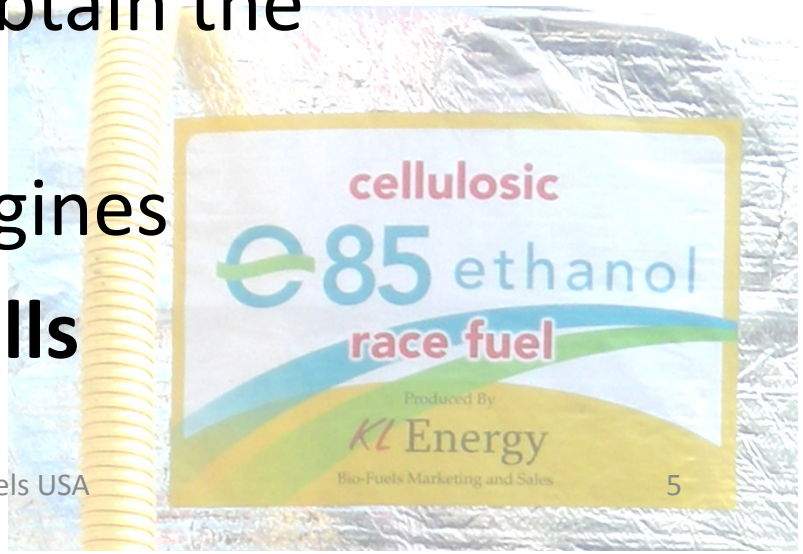
What Are Advanced Biofuels?

A Practical Definition

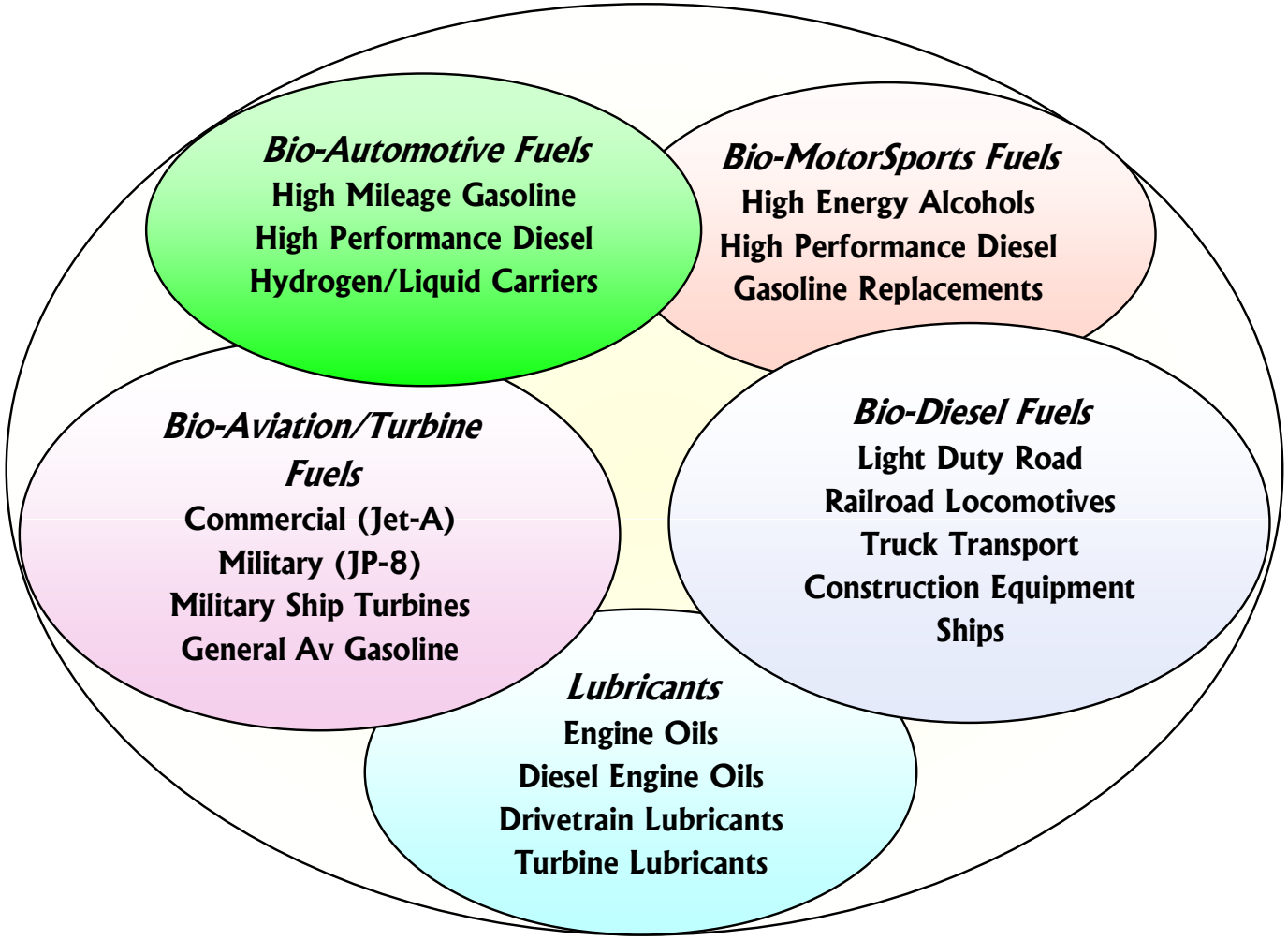
- **Advanced Biofuels are high-energy <u>liquid fuels, ususally used for transportation</u>**
- Derived from
  - Low nutrient input
  - High-yield **crops,**
  - Agricultural or forestry **waste,** or
  - Other **sustainable** biomass feedstocks including algae

Examples of Advanced Biofuels

- **Gasoline substitutes** (Grassoline; Green Crude)
- **Bio-diesel from non-food feedstocks**
- **Jet fuel made from biomass** (JP-8; Commercial Aviation fuels)
- **"Designer" fuels** tailored to obtain the most efficient, most powerful performance from specific engines
- **Hydrogen Carriers for Fuel Cells**



The Transportation Advanced BioFuel Universe



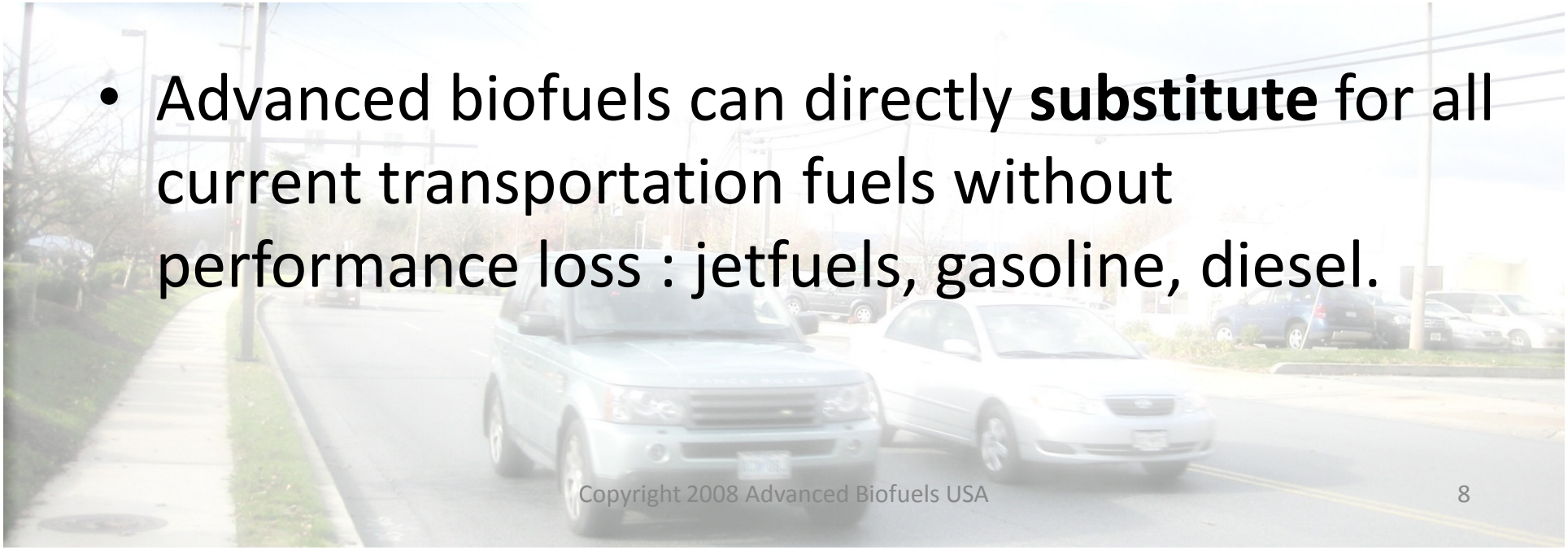
Atlantic Biomass Conversions, Inc.

Why Replacing Foreign Oil With Advanced Biofuels is Important

- The US imports about 16 Million Barrels of Oil Each Day.
- Approximately 90% of the oil is used as transportation fuel. The rest is used to produce plastics and related products.
- Virtually no oil is used to produce electricity in the US. **Windmills and solar can produce electricity but can not power jet airplanes.**

Why Advanced Biofuels Are Important

- The **quantities** of needed US transportation fuels cannot be produced by corn starch or sugar cane because not enough additional good crop land exists.



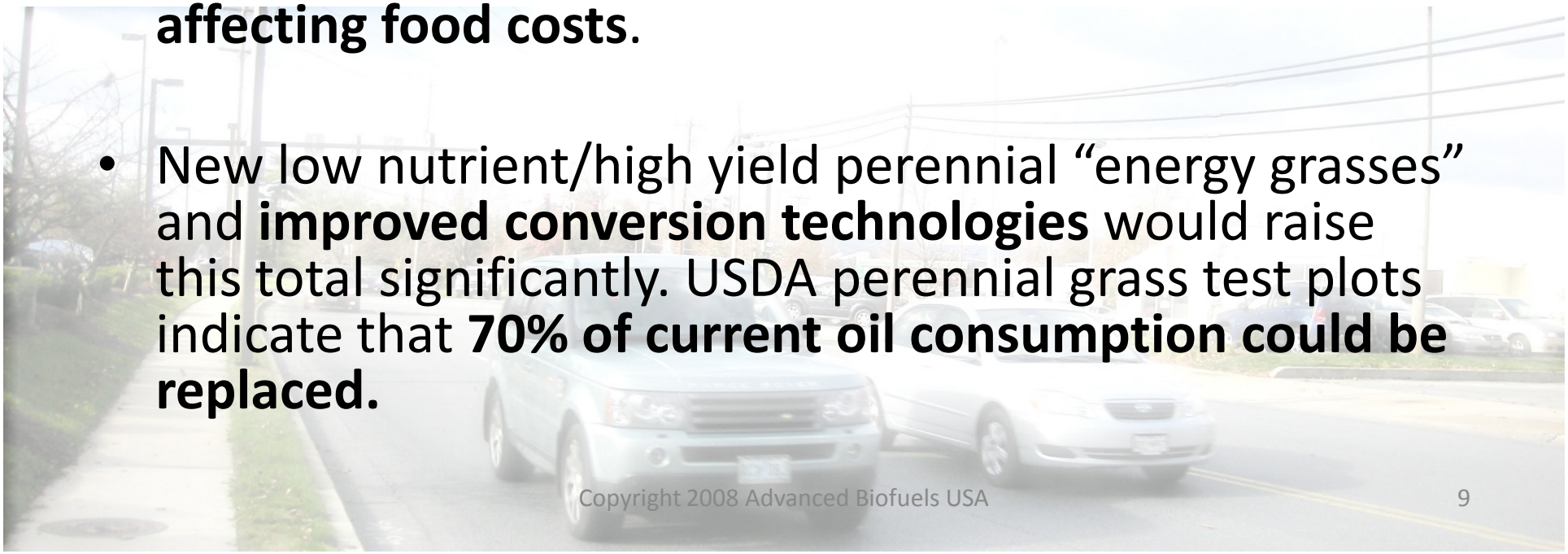
- Advanced biofuels can directly **substitute** for all current transportation fuels without performance loss : jetfuels, gasoline, diesel.

Why Advanced Biofuels Are Important

- Advanced biofuels can be produced from **non-food crops on marginal, non food-crop lands**.

- USDA (2005 "Billion Ton" study) estimates that with current crops and advanced biofuels technologies, **over 50% of current oil use could be eliminated without affecting food costs**.

- New low nutrient/high yield perennial "energy grasses" and **improved conversion technologies** would raise this total significantly. USDA perennial grass test plots indicate that **70% of current oil consumption could be replaced.**



Examples of Potential Feedstocks or Energy Crops

- Algae
- Corn stover
- Corn cobs
- Energy cane
- Sorghum
- Forestry waste
- Municipal waste
- Sawdust
- Chicken manure
- Agricultural residues
- Grasses such as
  - Switchgrass
  - Miscanthus
- Sugar beets
- Jatropha
- Camelina
- Coffee grounds
- Paper/pulp mill waste
- Jerusalem artichokes
- And more…

Additional Benefits of Advanced Biofuels

Advanced Biofuel technologies and emerging energy crops:

- **Do Not Increase Food Prices or Disrupt Food Supplies**
  - May use indigenous crops world-wide
- **Create good-paying jobs**
  - Jobs in science, engineering, construction, manufacturing, transportation and agriculture
- **Revitalize forestry and agricultural communities**
  - Increase the value of marginal land
  - Add value to agricultural and forestry leftovers
  - Give rural youth new reasons to "stay on the farm"
- **Mitigate Adverse Climate Change Effects**
  - Reduce Green House Gases in the atmosphere
  - Reduce our "carbon footprint"

A Few Types of Jobs Available in Advanced Biofuels Production

- Biologists
- Biologists specializing in genetic research
- Biologists specializing in plant cells
- Chemists
- Chemical engineers
- Systems engineers
- Researchers into bioenergy crop development
- Agriculture/horticulture experts
- Farmers
- Farm workers
- Industrial engineers
- Industrial architects
- Construction workers, managers
- Truck drivers
- Plant operations managers
- Fueling station operators
- Freight railroad operators, engineers, loaders, unloaders
- Equipment operators, technicians
- Farm product purchasers/traders
- Agricultural and Forestry Supervisors
- Agricultural Inspectors
- Computer Software Engineers
- Refinery Equipment Manufacturers
- And many others

Questions and Thoughts

- How might you use advanced biofuels in your daily life?
- Why do we want to replace imported oil with advanced biofuels?
- What makes some areas good for cultivating crops for advanced biofuels rather than for food or feed?

Class or Student Projects

- List items that require power. Note the current source of that power. Could advanced biofuels replace that power source?

- Review the list of potential advanced biofuels feedstocks or energy crops. Find pictures, give descriptions or definitions of each.

Advanced Research Suggestions

- What are the challenges to developing feedstocks for advanced biofuels?

- Research and discuss the **direct** emissions produced to propel a typical car or light truck with gasoline, diesel, biodiesel, advanced biodiesel, ethanol from corn starch, cellulosic ethanol, advanced biofuels from other feedstock and to propel a plug-in hybrid or electric car using coal-based, nuclear-based and solar or wind-based electricity.

What's so Advanced about Advanced Biofuels?

Find out more: www.AdvancedBiofuelsUSA.org

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