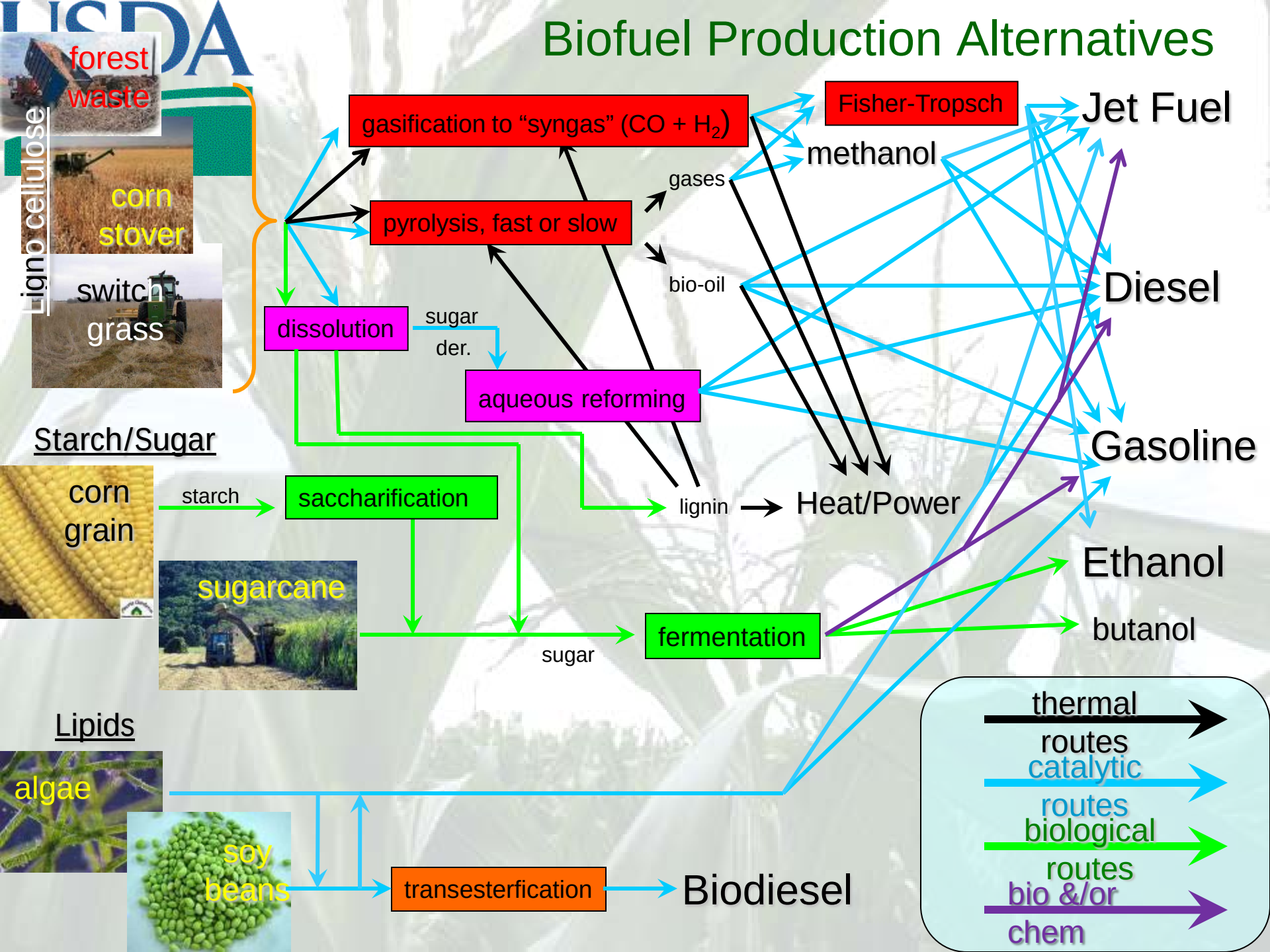
# Biofuel Production Alternatives



# *ARS Spending for Bioenergy Research*

thousands of dollars

| 2008 | 2009 | 2010 & 2011 | 2012 (proposed) |
|---|---|---|---|
| **$21,339** | **$32,359** | **$33,746** | **$37,086** |
| **Feedstock Development** | **21%** | **18%** | **21%** |
| **Sustainable Feedstock Production** | **26%** | **29%** | **36%** |
| **Biorefining** | **53%** | **53%** | **43%** |

# USDA/ARS *Biorefining Research*

**Enable new commercially-preferred biorefining technologies**

- **Biocatalytic (EtOH & BuOH)**
  - **1st Gen. –** ***starches & sugars***
  - **2nd Gen. –** ***cellulosic***
- **Thermochemical**
  - **Pyrolysis** ***(CHP, advanced biofuels)***
- **Biodiesel**
  - **Fuel quality** ***(cold flow, ox. stability)***

## USDA Strengths

- ✓ **Biorefinery co-products/byproducts**
  - **for each biorefining platform**
- ✓ **Biocatalysis & industrial microbiology**
- ✓ **Techno-economic analyses**
  - **identify R&D goals & priorities**
- ✓ **Early-stage technology transfer plans**
  - **pilot facilities**

## Focus Going Forward

1. **Feedstock-flexible**
2. **Farm-scale**

# USDA/ARS *Biorefining & Co-Products Teams*

## 1st Gen: *Starch-based ethanol*

- ***Wyndmoor, PA***
  - ✓ *biorefinery co-products*
  - ✓ *grain milling/fractionation*
  - ✓ *energy barley*
  - ✓ *enzymes for energy efficiency*
  - o *Sustainable Biofuels and CoProducts (Kevin Hicks)*
- ***Peoria, IL***
  - ✓ *contamination control*
- ***Albany, CA***
  - ✓ *membrane-based separations*

## 2nd Gen: *Cellulosic ethanol*

- ***Peoria, IL***
  - ✓ *pretreatment*
  - ✓ *saccharification enzymes*
  - ✓ *pentose-fermenting yeasts*
  - ✓ *inhibitor-tolerant yeasts*
  - ✓ *biorefinery co-products*
  - o **Bioenergy (Mike Cotta) & Renewable Product Technol. (Joe Rich)**
- ***Albany, CA***
  - ✓ *deconstruction enzymes*
- ***Wyndmoor, PA***
  - ✓ *biorefinery co-products*

## *Techno-economic analysis*

- ***Wyndmoor, PA***
  - o **Andy McAloon**

# USDA/ARS Biorefining & Co-Products Teams (cont.)

## Pyrolysis

- Wyndmoor, PA (fast pyrolysis)
- New Orleans, LA (slow pyrolysis)
- Florence, SC (manures)
- Peoria, IL (catalytic pyrolysis)

## Butanol

- Peoria, IL

## Biodiesel

- Peoria, IL
  - ✓ specialty oilseeds – pressing/refining
  - ✓ fuel composition & quality
  - ✓ analytical methods
  - ✓ glycerol-based polymers
- Wyndmoor, PA
  - ✓ process development and QA
  - ✓ glyerol-based co-products