USDA REE Strategic Energy Science Plan

Vision *– In five years the US will have:*

- **Agriculture- and natural-resource-based energy that enhances stewardship of our environment**
- **Sustainable, secure, renewable energy sources**
- **Vibrant and energy-efficient rural communities**

Goals **–**

- **Sustainable, agriculture- and natural resource-based energy production**
- **Sustainable bioeconomies for rural communities**
- **Efficient use of energy**
- **Workforce development for the bioeconomy**

www.ree.usda.gov/news/bead/USDA_REE_strat_plan.pdf

ARS Bioenergy Research
Strategic Vision

ARS bioenergy research:

- **Enables new varieties and hybrids of bioenergy feedstocks with optimal traits *(Feedstock Development)***
- **Enables new optimal practices and systems that maximize the sustainable yield of high-quality bioenergy feedstocks *(Feedstock Production)***
- **Enables new commercially-preferred biorefining technologies *(Biorefining)***

ARS Bioenergy Research
Strategy

Expected Outcomes & Impacts:

- **Enable America's transition to renewable sources of energy and biobased products.**
- **Enables farmers and rural America maximize their economic returns from the production of bioenergy and biobased products.**
- **Realize important environmental benefits such as:**
  - **reducing greenhouse gas emissions**
  - **increasing carbon sequestration**
  - **creating safe value-added products from wastes**
  - **maintaining the long-term productivity of agriculturally-relevant natural resources such as soil and water**
  - **reclaiming unproductive lands**
  - **rehabilitating unhealthy lands.**

ARS Bioenergy Research Strategy

Expected Outcomes & Impacts (cont.):

- **Realize significant new environmentally, economically and socially sustainable economic opportunities for rural America, without upsetting agriculture's traditional markets for food, feed and fiber.**
- **Allow rural America to become more self-sufficient in energy, thereby minimizing energy cost volatility (and maximizing local control over energy costs) in rural communities.**
- **Improve national security and the U.S. trade balance by reducing America's dependence on imported petroleum.**

ARS Bioenergy Research
Interagency Coordination

Inter-Departmental:

- **Biomass R&D Board**
  - **Federal-wide Biofuels Action Plan**
  - **Interagency Working Groups**
- **Scientist exchange program with DOE-OS** ***(Bioenergy Research Centers)***

Intra-USDA:

- **USDA Energy Council**
- **USDA Biobased Products & Bioenergy Coordination Council (BBCC)**
- **REE Agricultural Bioenergy and Bioproducts Research, Education and Economics (ABBREE) Council**

ARS
Bioenergy Research

Multiple national programs contribute…

- **Bioenergy** *(307)*
- **Agricultural quality & utilization** *(306)*
- **Forages** *(205)*
- **Soil sustainability** *(202)*
- **Crop improvement & protection** *(301, 302, 304)*
- **Manure utilization** *(206)*
- **Integrated ag systems** *(207)*

ARS Bioenergy Program Components

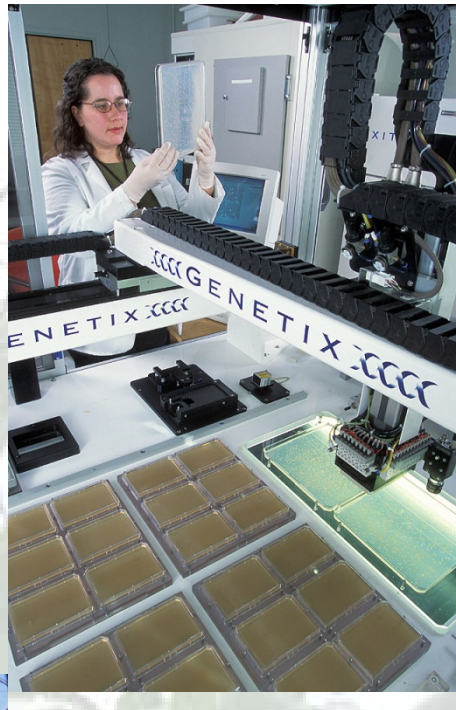
Three Components – Four Teams

1. **Feedstock Development**
   Kay Simmons (L), Ev Byington
2. **Feedstock Production**
   Jeff Steiner (L), Ev Byington
3. **Biorefining**
   Bob Fireovid (L), Frank Flora, Jeff Steiner

Integration
Bob Fireovid (L), Kay Simmons, Jeff Steiner, Ev Byington, Frank Flora

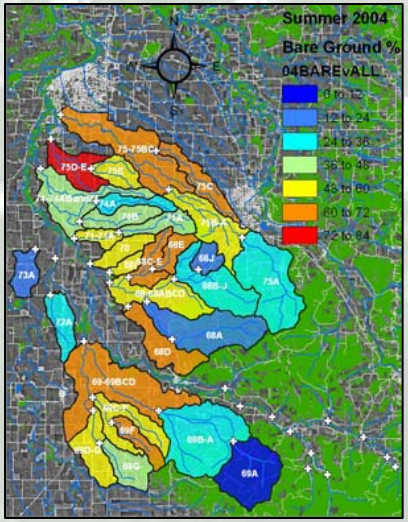
Feedstock Development

- **Biological and molecular basis for plant traits**
  - **Understand molecular basis for key traits** *(cell-wall structure, growth biomass yield, conversion potential)*
- **Breeding and evaluation of new germplasm**
  - **Improved germplasm & varieties for energy crops**



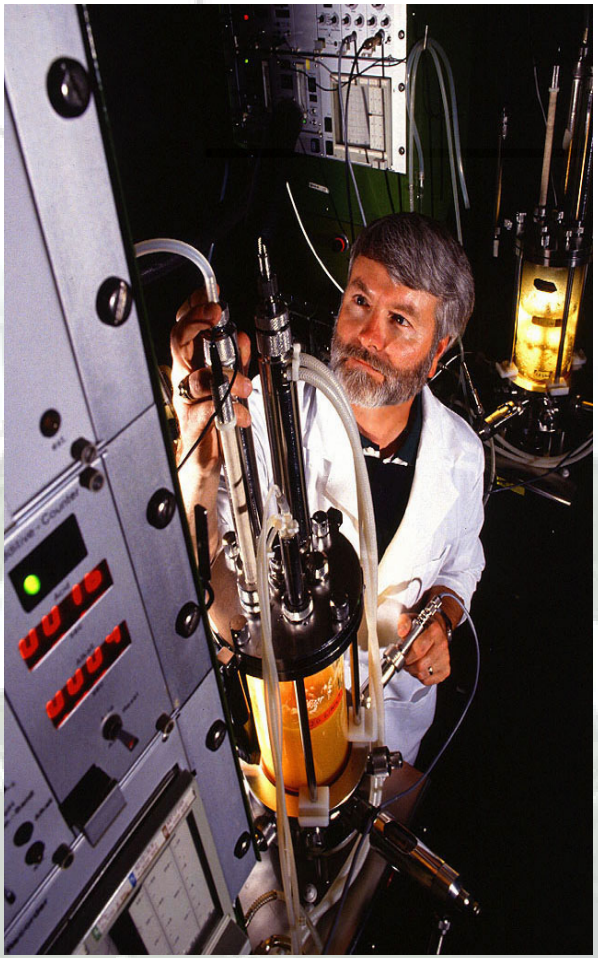
Feedstock Production

- **Region-specific, sustainable practices to maximize feedstock harvest**
  - **Whole-farm optimization tools to incorporate bioenergy feedstock production into farm operations**
- **Analytical tools to estimate potential feedstock amounts and the implications of harvest on natural resource base**
  - **Decision tools for farmers and biorefinery operators**
- **On-farm utilization of byproducts**
  - **Physical, chemical and biological value of byproducts as soil amendments and nutrients**



Biorefining

- Biochemical (EtOH & BuOH)
  - starches & sugars *(1st gen.)*
  - cellulosic *(2nd gen.)*
- Thermochemical
  - farm-scale
  - crop and animal wastes
- Biodiesel
  - fuel quality *(cold flow, oxidative stability, etc.)*
- Process economics; market & life cycle analyses
  - identify R&D goals & priorities
- Biorefinery co-products/byproducts
  - For each biorefining platform *(biodiesel, biochem, thermo)*
- Upfront tech transfer plans & partners
  - pilot facilities *(ARS regional research centers)*



Program Integration

Cross-Component Coordination Critical

- **Development & Production**
  - **field testing new varieties**
- **Development & Conversion**
  - **conversion testing**
  - **optimizing co-products**
- **Production & Conversion**
  - **feedstock preprocessing, pretreatment, handling, quality**

Stakeholder-aligned cross-Component Coordination Teams

- **Cellulosics to EtOH/BuOH**
- **Lipids to fuels**
- **Starches/sugars to EtOH/BuOH**
- **Thermochemical processing**