Tennessee Biofuels Initiative

… from Grow to Go

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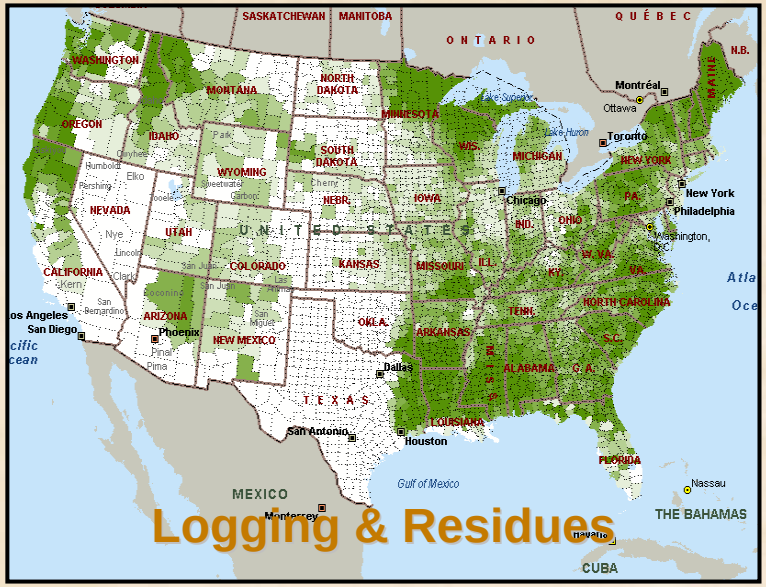
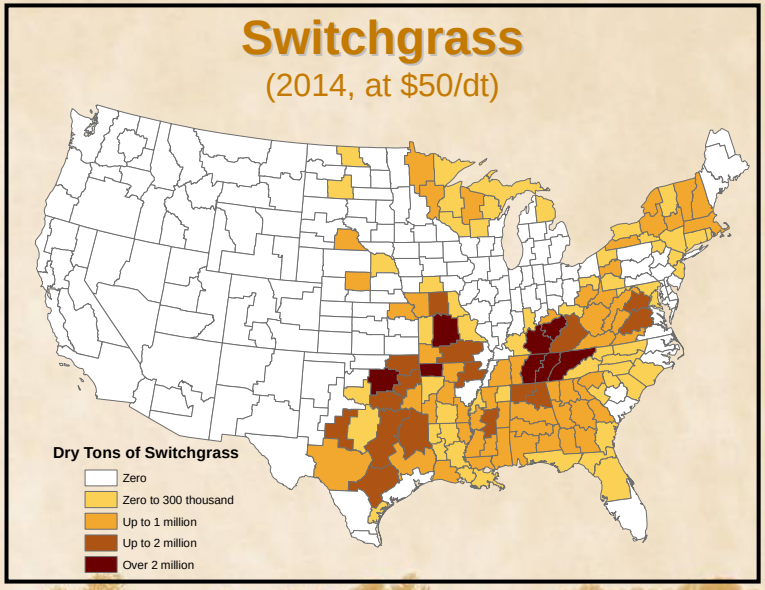
Our Comparative Advantage



Perlack, R.D., et al. 2005. Biomass as Feedstock for a Bioenergy and Bioproducts Industry: Technical Feasibility of a Billion-Ton Annual Supply.



Ugarte, et al. 2006. Economic Implications to the Agricultural Sector of Increasing the Production of Biomass Feedstocks to Meet Biopower, Biofuels and Bioproduct Demands.

Comprehensive Approach

Energy Crops

Biochemical Conversion

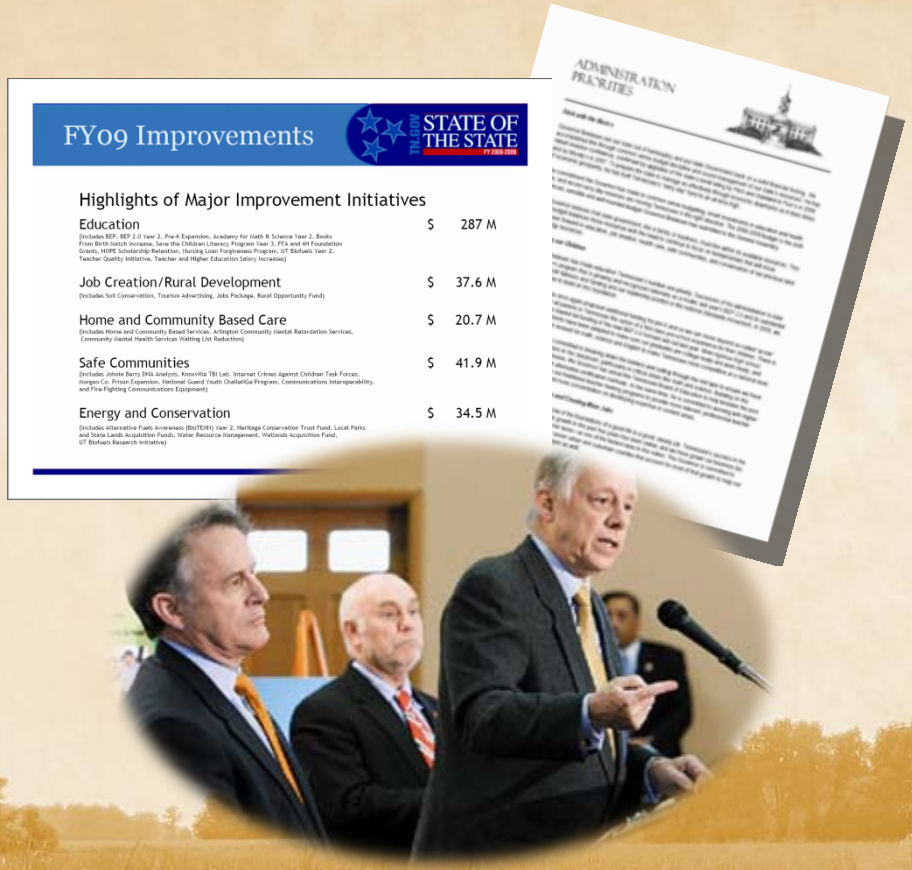
Consumer Products

Industrial Processing

Integration is Key

- Integrated objectives require strategic partnerships:
  1. Demonstrate the establishment of a dedicated biomass energy crop supply chain with farmers
  2. Demonstrate the pre-commercial production of ethanol from switchgrass
  3. Establish premier long-term research capability in bioenergy and bioproducts
  4. Develop a viable, sustainable, long-term path to commercialization of cellulosic biofuels in Tennessee

State of Tennessee Commitment



- Significant 5-year funding commitment totaling $70.5 million
  - $60 million appropriated to date
- Sustained commitment
- Business-like approach
- University led and managed; leverages partnerships
- Part of a State investment of one-quarter Billion $
  - ORNL BioEnergy Science Center
  - Southeastern Sun Grant Center

Enabling Partnerships

State
- Capital Funds ($40.7 MM)
- Operating Funds ($30 MM)

UT
- Switchgrass production
- Project accountability
- Research

UTRF
- UT intellectual property management

Genera
- TN limited liability company
- Partnerships, capital projects, operations

Genera energy

Feedstock Partners

Technology Partners

Other Partners

Demonstration, Improvements, Scale-Up, Commercialization

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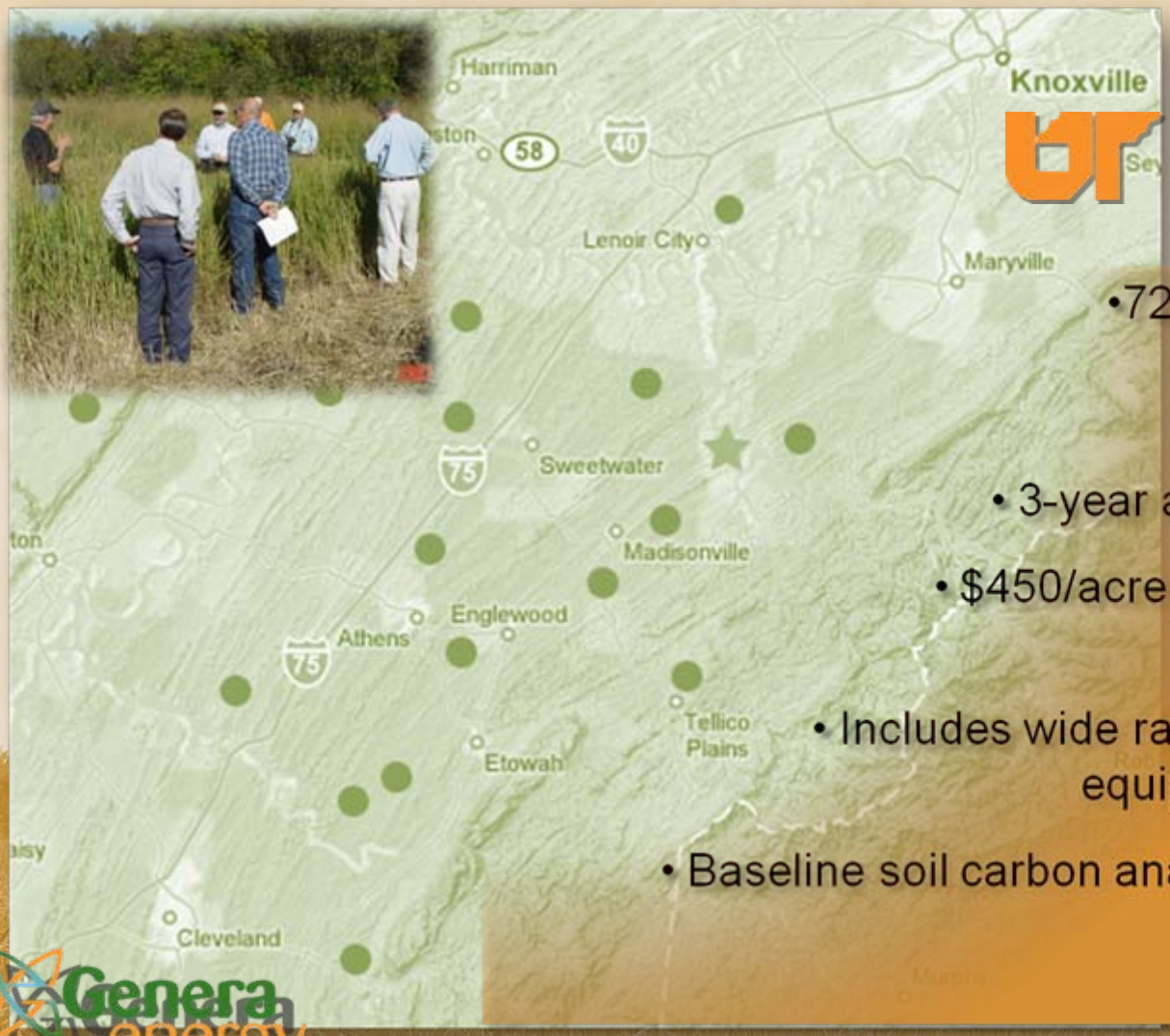
UT BIOFUELS INITIATIVE

Genera energy

Switchgrass Focus

- Well suited to the Southeast
  - Currently, ~6-8 tons/acre in TN
  - Potential for 12+ tons/acre
- Warm season, native, perennial grass
- Tolerates poor soils, flooding, drought
- Highly resistant to many pests and plant diseases
  - Low use of chemicals or fertilizers
- 1-2 year establishment
  - Weed control critical in establishment
- Initial production practices similar to hay
  - Working toward next generation harvest, storage, management improvements
- UT has long history of switchgrass production and market research

Farmer Incentive Program



UT Extension

- 723 acres in 2008, expect 2,000 acres in 2009, expanding to ~6,000
- 3-year acreage-based contract
- $450/acre per year plus seed and technical assistance
- Includes wide range of soils, prior uses, equipment, weed pressures
- Baseline soil carbon analysis, part of long-term environmental studies

Genera energy

Feedstocks for Fuels

- Commercial cellulosic biofuels require:
  - Adequate, sustainable feedstock supply
  - Consistent feedstock quality
  - Economical supply chain
- Research & demonstration needed in:
  - Crop development
  - Farm production
  - Harvesting and storage
  - Transportation and logistics
  - Feedstock quality
  - Feedstock characterization
  - Environmental factors

“Bioneering” Work Needed

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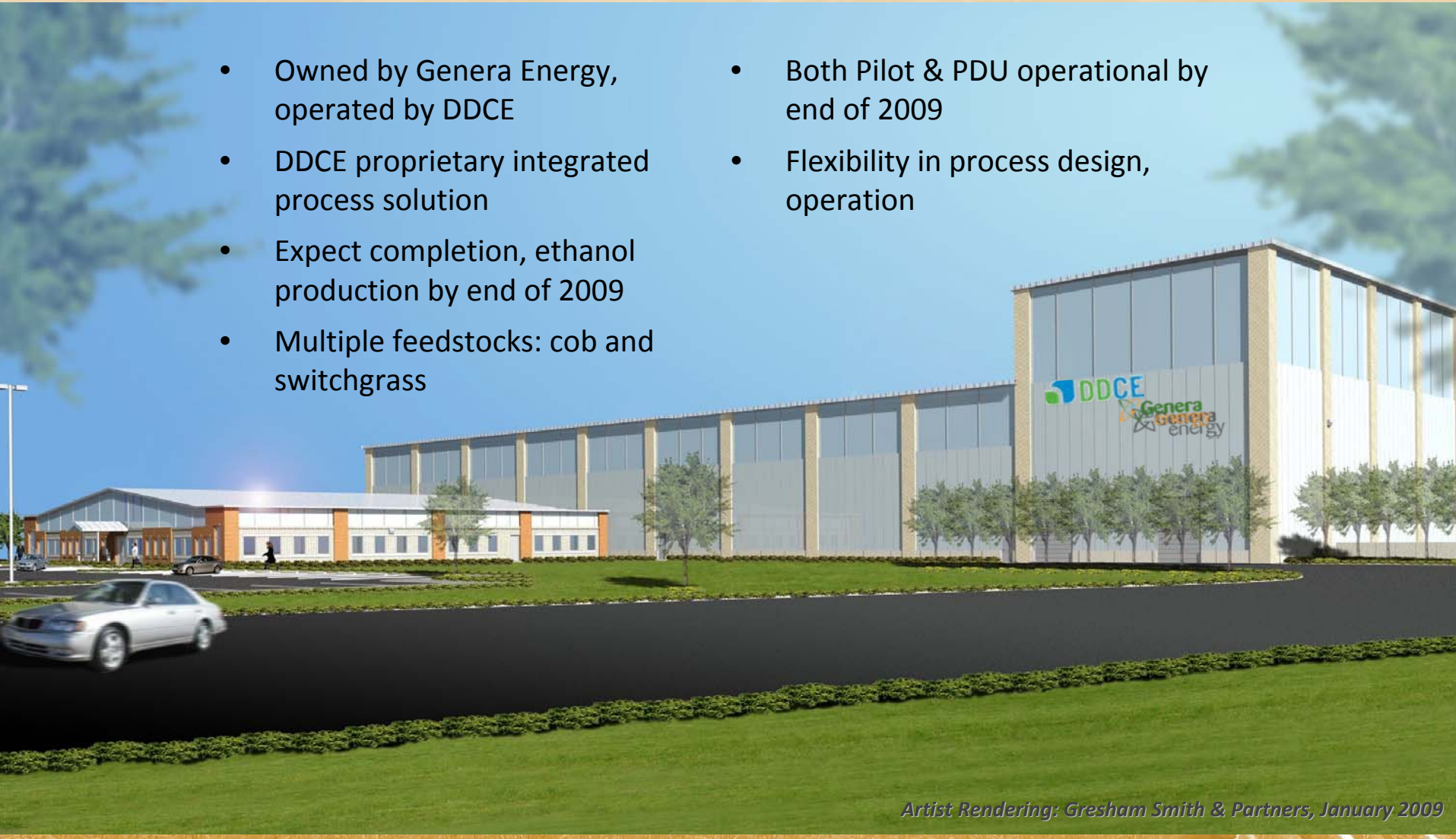
UT BIOFUELS INITIATIVE

Genera energy

Pilot Biorefinery

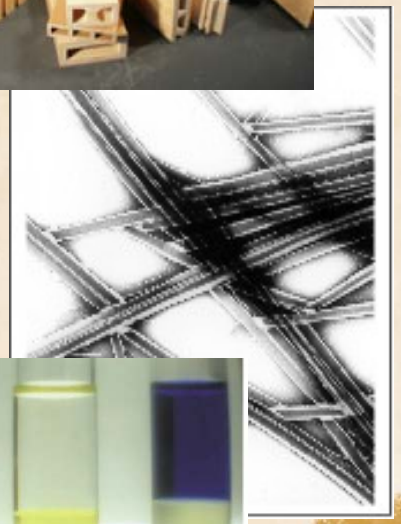
- Collaboration with DuPont Dansico Cellulosic Ethanol, LLC
- Vonore location: Niles Ferry Industrial Park, Monroe County, 32 acres
- Optimized as precursor to commercial demonstration (~20 MGY)
- Pilot plant (250,000 gpy) and Process Development Unit (PDU)
- Long-term operation as an RD&D facility

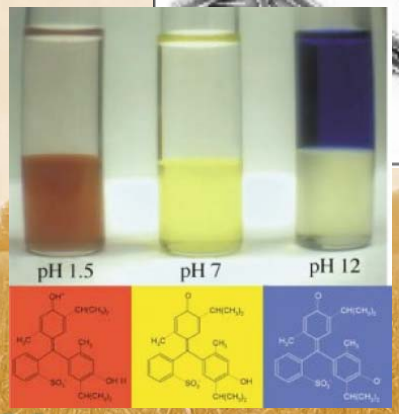
- Owned by Genera Energy, operated by DDCE
- DDCE proprietary integrated process solution
- Expect completion, ethanol production by end of 2009
- Multiple feedstocks: cob and switchgrass
- Both Pilot & PDU operational by end of 2009
- Flexibility in process design, operation



Artist Rendering: Gresham Smith & Partners, January 2009

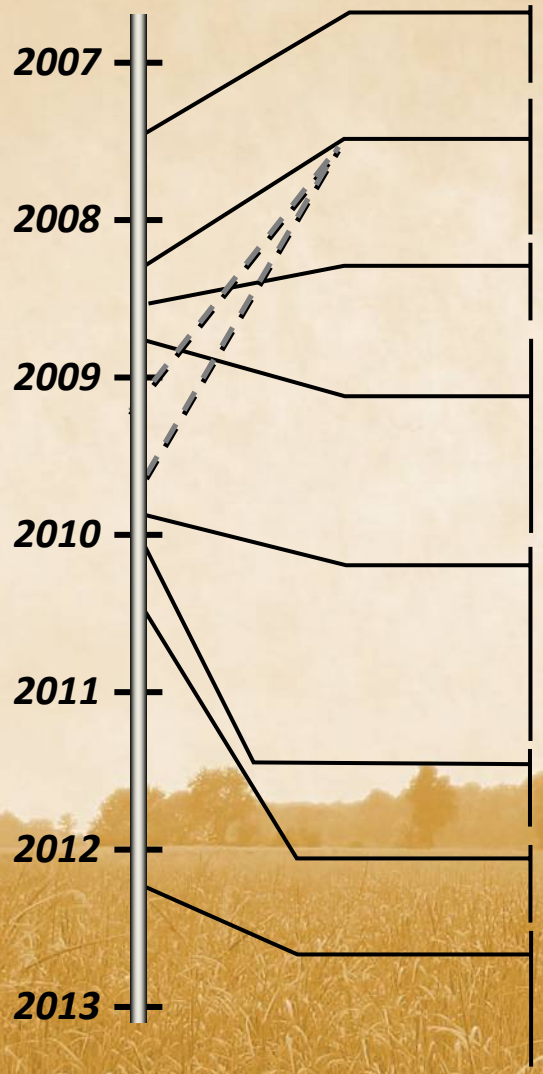
Coproduct Utilization





- Lignin and solid residue will initially provide heat and energy for the process
- Product diversification is important to economic viability of the biorefinery
- Research addresses development of chemical building blocks and novel, value-added products

The Pathway Forward

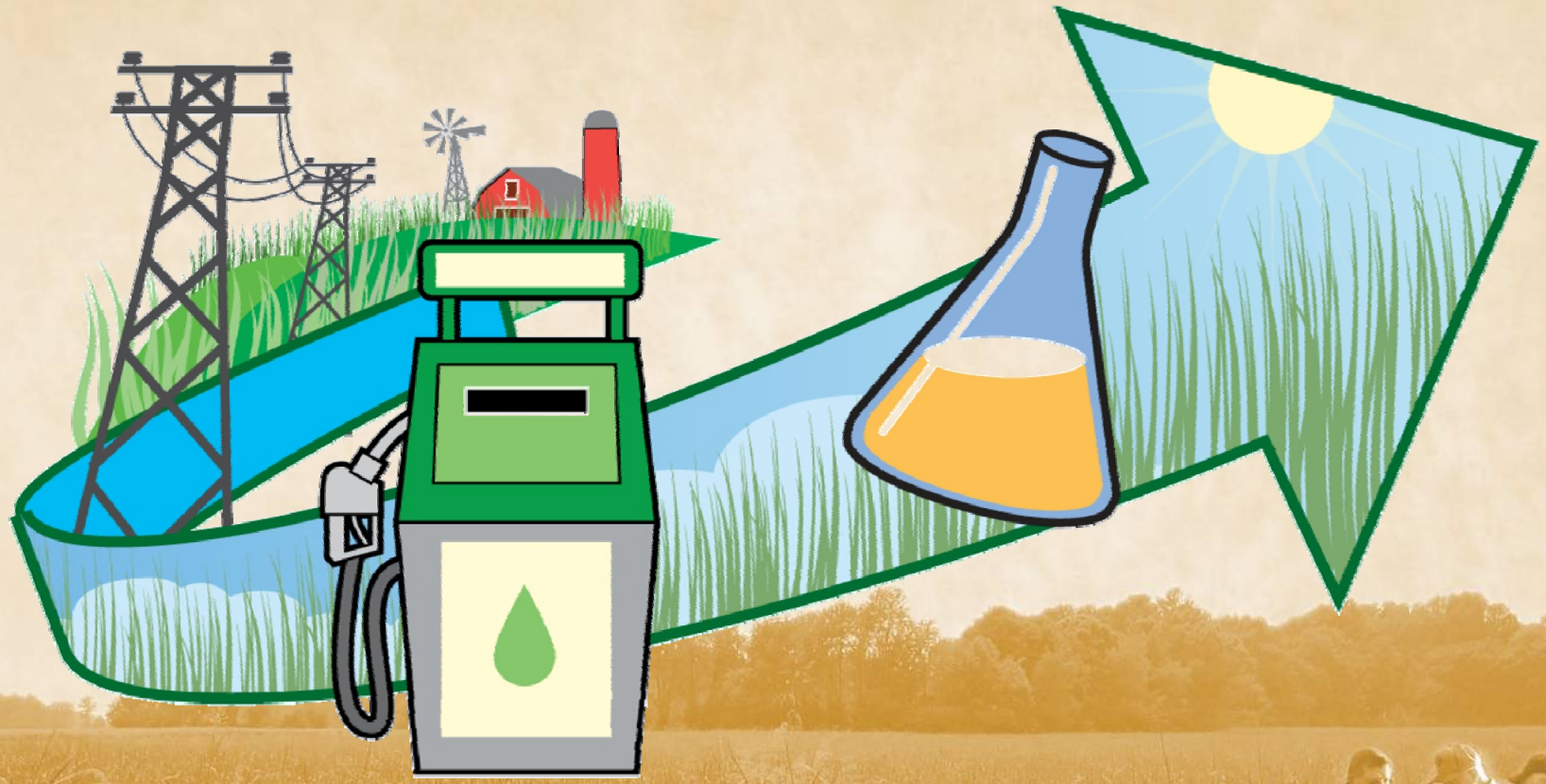


- State funding approved
- Initial switchgrass plantings (723 acres 2008, + ~2,000 acres 2009, + ~3,000 acres 2010)
- Partnership with DDCE
- Groundbreaking for pilot biorefinery
- 12-14 month construction phase
- First gallon of Grassoline produced
- Launch integrated business solution for biomass supply
- Commence pellet mill operations
- First commercial-scale (~20 MGY) cellulosic ethanol facility in TN

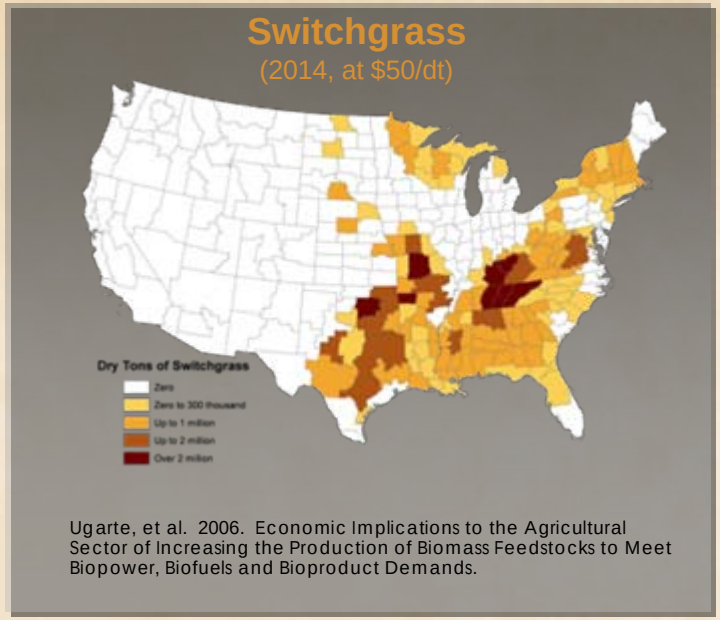
Key Challenges

- Biomass availability, cost
- Economic competitiveness
- Investment capital for buildout
- Supportive, sustained policy
- Distribution infrastructure

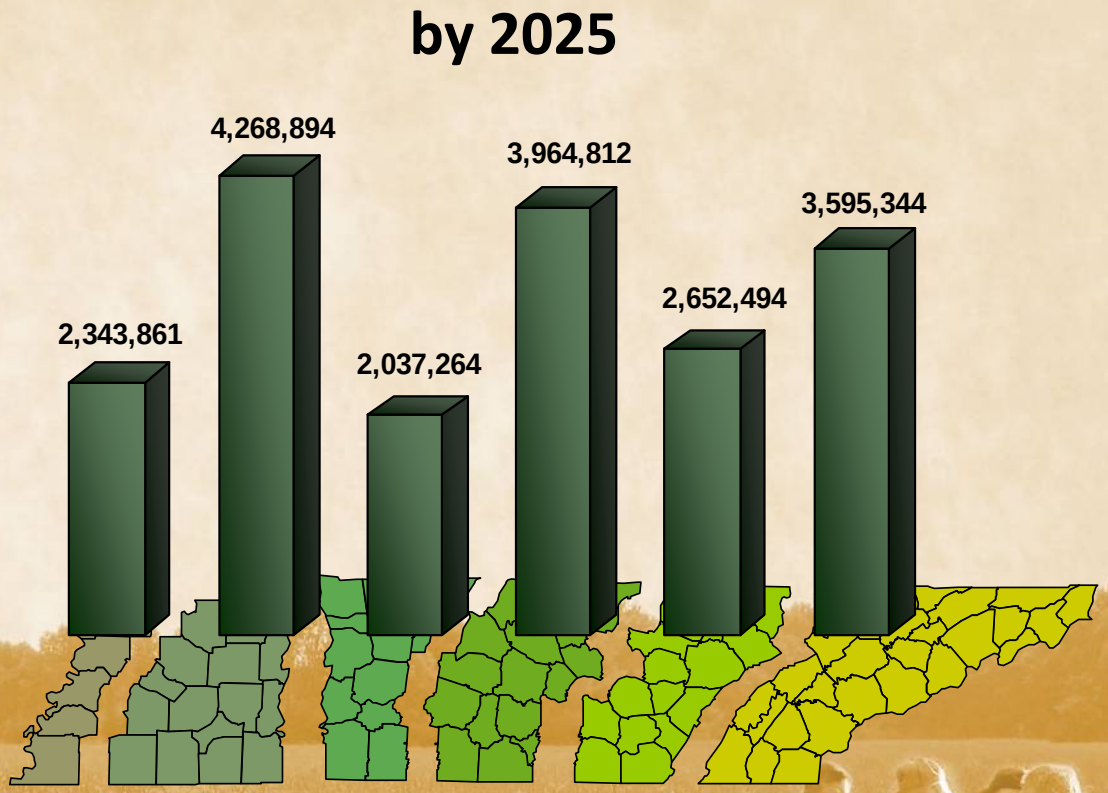
Biomass: The Common Denominator



TN Switchgrass Potential



- Dry tons of switchgrass
- Assuming $40 dt at the farm gate
- Assuming yields around 6 dt/acre
- Without disrupting sector balance



Tennessee Leading by Example

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