

Preliminary Economic Impact and Consequences of Large Scale Biomass Energy Production in Kentucky

Prepared for the
Governor's Biomass and Biofuels Taskforce
October 14, 2009

**College of Agriculture
Biomass Energy Impact Study Group**

Study Focus

- Examine the probable economic impacts and related consequences of large scale biomass-biofuel production in Kentucky.
- A preliminary analysis since the expansion path of biomass-to-biofuel has uncertainties and risks at this time.
- Not a feasibility analysis of biomass alternatives or biofuel processing.

General Assumptions

- Advanced bio-fuel expansion will be driven by regulatory demands – Renewable Fuels Standards and potential climate legislation.
- Federal and state subsidies/cost-share will be available for plant construction and biomass production.
- Financial incentives will be positive for on-farm production of energy crops.

Our Approach

- Develop a scenario for potential expansion of biomass utilization and production and biofuel processing

**Can Kentucky Develop a
25 MTY Biomass
Industry?**

S.A. Shearer
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Our Approach

- Develop a scenario for potential expansion of biomass utilization and production and bio-fuel processing
- Apply conventional economic impact analysis (IMPLAN) using KY-specific economic sector data and multipliers.

Economic Impact Assessment

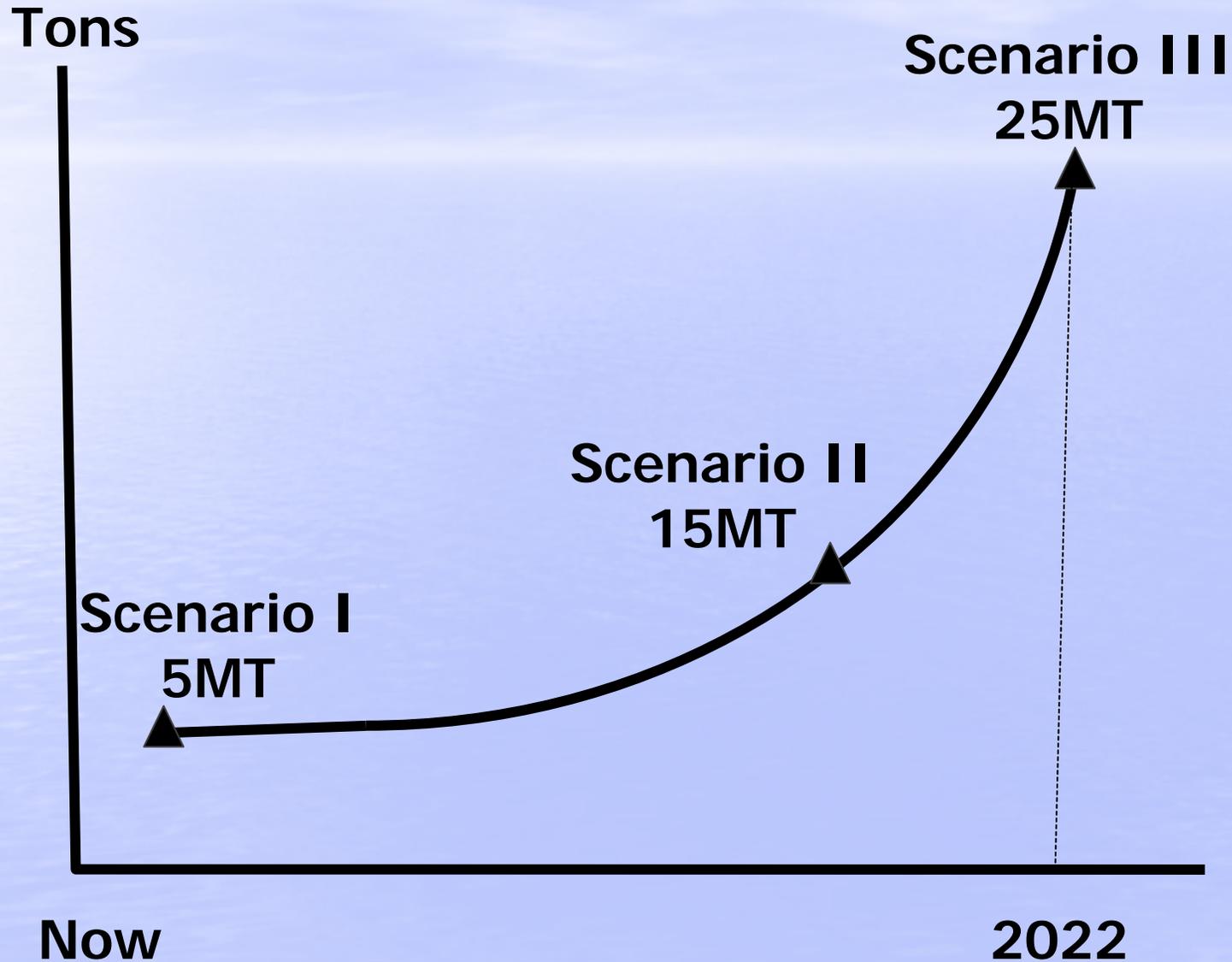
Type of Analysis	Type of Industry	Event Level		
Industry Sales	Bio Diesel (4M)			
Initial	Indirect	Induced	Total Impact	
Multiplier	1	0.05	0.06	1.11
Impact				

IMPLAN



Pro

A Three-Step Scenario for Biomass Expansion Path in Kentucky



Scenario I – 5MT

2.5MT Agricultural
Waste (Stover)

2.5MT Forest Waste

100% Co-Firing for
Electricity

Scenario I - Assumptions

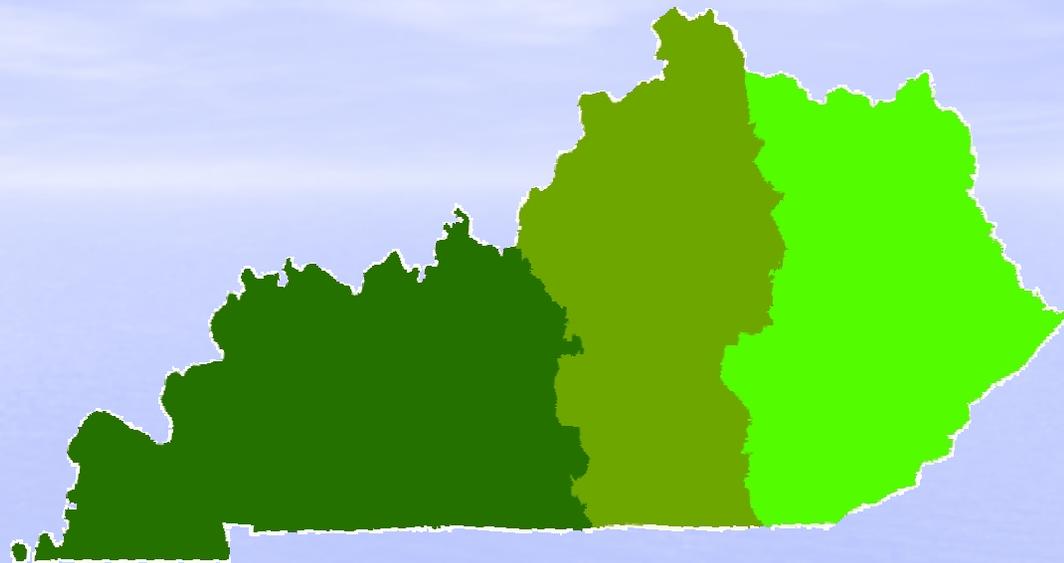
- Ag residue is primarily corn stover (round bales); wood waste is forest harvest residue (chips).
- Feedstock is KY all sourced.
- Five coal-fired electric plants retro-fitted for biomass co-firing.
- Transportation direct to power generation.

Preliminary Economic Impacts of Scenario I

Estimated Biomass Utilization	5 MT
Energy Potential	
Estimated Ethanol Production	0
Estimated Biomass Power (coal equivalent)	3.6MT
Probable Economic Impacts	
Construction Phase	
Employment Changes	146 - 293
Direct Output Impacts	\$16M - \$32M
Operation Phase	
Employment Changes	648 - 792
Direct Output Impacts	\$193M - \$236M
Total Output Impacts	\$302M - \$370M

Related Consequences of Scenario I

Land Use Changes	Acres
Hay	0
Pasture	0
Cropland	0
Total Ag Land	0



Hay

Pasture



Cropland

Total Ag Land



Scenario II – 15MT

2.5MT Agricultural
Waste (Stover)

2.5MT Forest Waste

100% Co-Firing for
Electricity

5.0MT Energy Crop
Switchgrass (70%)
Miscanthus (30%)

5.0MT Forest Harvest +
Woody Biomass

50% Ethanol
50% Co-Firing for
Electricity

Scenario II - Assumptions

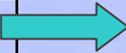
- Maximum sustainable forest waste and harvest utilization (~7.5MT).
- Portfolio of energy crops contribute 5MT
- 100 collection & densification plants.
- Six cellulosic ethanol plants.
- No major logistical constraints; no imports or exports of biomass.

Preliminary Economic Impacts of Scenario II

Estimated Biomass Utilization	15 MT
Energy Potential	
Est. Ethanol Production	400MG
Est. Biomass Power (coal equivalent)	7.2 MT
Probable Economic Impacts:	
Construction Phase	
Employment Changes	2,755 - 8,794
Total Output Impacts	\$280M - \$479M
Operation Phase	
Employment Changes	6,404 - 7,828
Direct Output Impacts	\$1.19B - 1.49B
Total Output Impacts	\$1.95B - \$2.49B

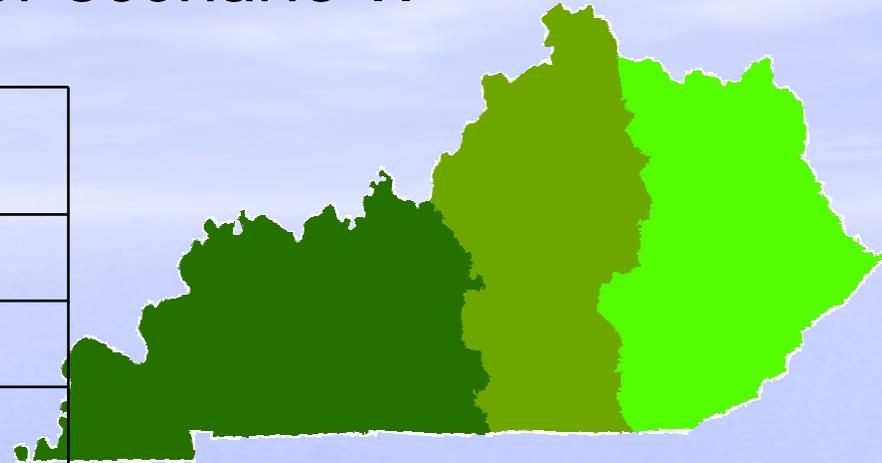
Preliminary Economic Impacts of Scenario II

Estimated Biomass Utilization	15 MT
Energy Potential	
Est. Ethanol Production	400MG
Est. Biomass Power (coal equivalent)	7.2 MT
Probable Economic Impacts:	
Construction Phase	
Employment Changes	2,755 - 8,794
Total Output Impacts	\$280M - \$479M
Operation Phase	
Employment Changes	6,404 - 7,828
Direct Output Impacts	\$1.19B - 1.49B
Total Output Impacts	\$1.95B - \$2.49B

 **~ 80%**
**Transportation
 Densification**

Related Consequences of Scenario II

Land Use Shifts	Acres
Hay	250K - 400K
Pasture	470K - 550K
Cropland	40K - 80K
Total Ag Land	780K - 1.01M
Livestock Production Impacts:	
Cow Equivalent Loss	285K - 348K
Livestock Revenue Loss	\$139M - \$171M



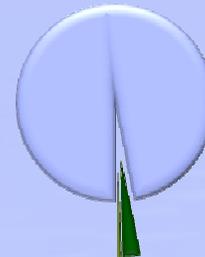
Hay



Pasture



Cropland



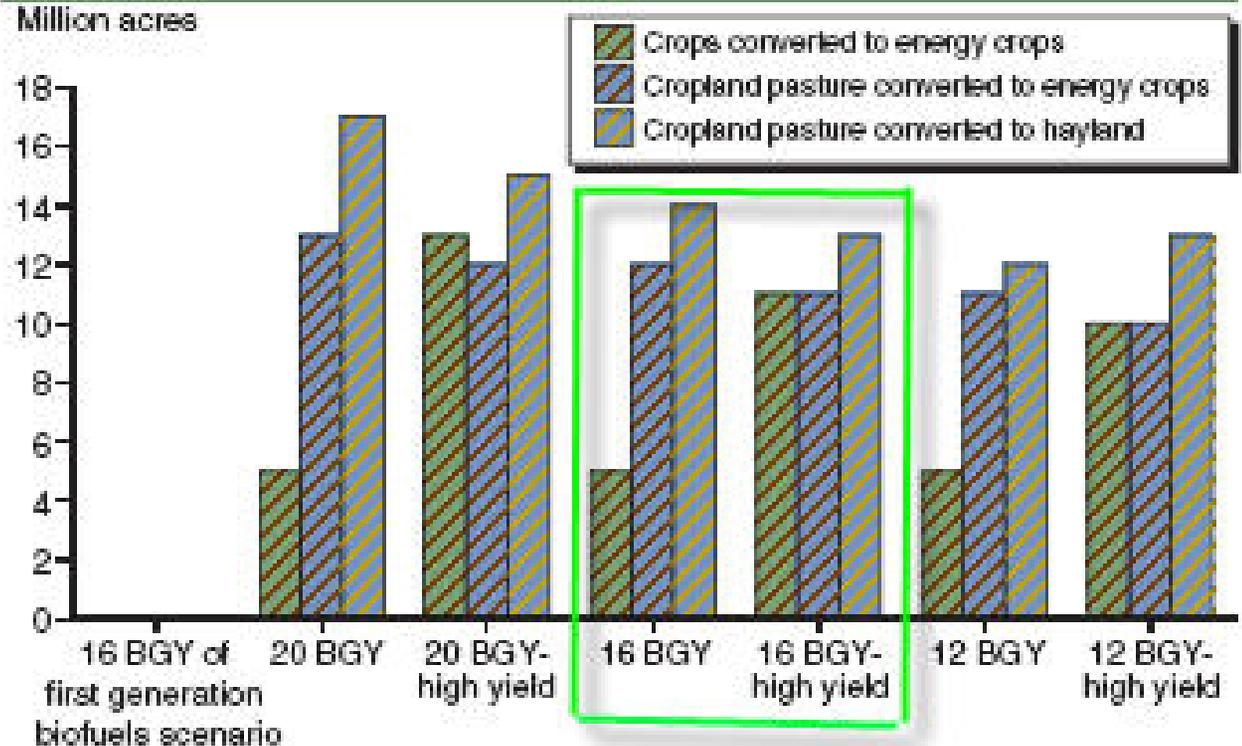
Total Ag Land



• Land use shifts consistent with USDA study of biofuel production



Figure 6.3b
Changes in land use to accommodate energy crops in 2022



"...analysis results suggest a significant amount of cropland used as pasture is planted to energy crops and hay to make up for lost forage." p. 72 (December 2008)

Scenario III - 25MT

2.5MT Agricultural
Waste (Stover)

2.5MT Wood Waste

15.0MT Energy Crop
Switchgrass (70%)
Miscanthus (30%)

5.0MT Forest Harvest +
Woody biomass

100% Co-Firing for
Electricity

50% Ethanol
50% Co-Firing for
Electricity

Scenario III - Assumptions

- Additional biomass from energy crops (+10MT) to reach 25MT goal by 2022.
- Yields on portfolio of energy crops rise 35%.
- One additional very large scale ethanol plant (200MGY).
- No major logistical constraints; no imports or exports of biomass.

Preliminary Economic Impacts of Scenario III

Estimated Biomass Utilization	25 MT
Energy Potential	
Est. Ethanol Production	600MG
Est. Biomass Power (coal equivalent)	9.1 MT
Probable Economic Impacts	
Construction Phase	
Employment Changes	5,793 - 13,860
Total Output Impacts	\$601M - \$984M
Operation Phase	
Employment Changes	8,178 - 9,996
Direct Output Impacts	\$1.79B - \$1.93B
Total Output Impacts	\$2.55B - \$3.42B

Related Consequences of Scenario III



Land Use Changes	Acres
Hay	723K - 883K
Pasture	719K - 879K
Cropland	118K - 144K
Total Ag Land	1.98M – 2.42M
Livestock Production Impacts:	
Cow Equivalent Loss	627K - 767K
Livestock Revenue Loss	\$306M - \$374M

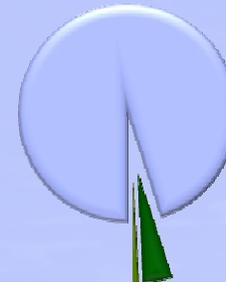
Hay



Pasture



Cropland



Total Ag Land



Summary

- Large scale biofuel production has probable major direct and indirect economic impacts in KY for both jobs and income.
- Majority of jobs created in transportation sector and at densification plants.
- Increased biomass production induces land use shifts in agriculture with significant impacts on livestock sector; others ag sector impacts not examined.

Summary

- Will feedstock be KY-sourced or will there be transshipment to/from other states?
- With better understanding of biomass expansion path, portfolio of energy crops, logistical requirements, and biotech impacts → estimate economic impacts with more confidence.
- Biomass/Biofuels represent such a major potential change in the structure of agriculture in KY → examine closely the farm management implications and risk for producers.