Kentucky yield projections for biofuel feedstock crops

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By 2025, Kentucky will derive from biofuels 12 percent of its motor fuels demand (775 million gallons/year, which represents approximately 20 percent of Kentucky’s current transportation fuels demand), while continuing to produce safe, abundant, and affordable food, feed and fiber.
Governor’s biofuel plan for 2025

- 775 million gallons
  - Corn starch for 1\textsuperscript{st} generation ethanol
  - Switchgrass and crop residues for 2\textsuperscript{nd} generation ethanol
  - Canola and sunflower for biodiesel

- How will this affect
  - Fossil fuel consumption?
  - Land use?

Goal: 775 million gallons of renewable transportation fuel by 2025

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Million gallons:
- Corn ethanol, 186
- Canola biodiesel, 107
- Corn stover ethanol, 121
- Switchgrass ethanol, 361

KY Plans to Increase Fossil Fuel Use

Figure 10: Kentucky Total Energy Consumption and Savings Potential (2025 Goal)

*S Historical renewable energy was derived from hydroelectric (52-75%) and biomass (24-45%); remainder was unspecified "other."
Conflicting forecasts to 2030

• Neither predicts 40% growth in supply
• Increasing demand in developing world

IEA: 30% growth

Uppsala University: 10% decline
KY Energy Consumption, 1960-2025

Trillion BTU

1960-73 Increasing annual growth rate
1973 Energy price shock
1979 Energy price shock
1986-2007 Decreasing annual growth rate
2008 Energy price shock

Governor’s “Business as Usual” projection: +40%
Follow ’97-’07 linear trend or state energy plan: +15%
No change from 2005
Follow ’86-’07 quadratic trend
Peak oil: -25%
Volatility and escalation: -40%?

Data from DOE-EIA, 2008
US Energy Consumption, 1950-2025

Energy consumption (EJ)

1950 1970 1990 2010
Kentucky sets biomass, biofuel production goals

By Kris Bevill

Report posted Sept. 11, 2009, at 12:01 p.m. CST

Kentucky has tasked a 23-member task force to facilitate the development of a state-based biofuel industry.

The task force held its first meeting Sept. 2, and determined the state needs to produce 25 million tons of biomass annually by 2025 in order for Kentucky to adequately contribute to the federal renewable fuel standard and a state renewable portfolio standard.

The state should also produce enough biofuels by 2025 to meet 12 percent, or 775 million gallons per year, of its transportation fuel demand.

“Kentucky’s had a good history in biofuels, yet sometimes we forget where we have been,” said Frank Moore, director of biofuels at the state’s department of energy development and independence. “There’s been a lot of biomass work done, but we are not sure that Kentucky has laid the proper foundation to develop an industry.” Moore is one of the organizers of the task force and said its purpose is to ensure that an appropriate policy is put in place to build the foundation for a biomass-based energy and fuel industry.

“Agricultural residues, forestry and energy crop production. ‘To get to 25 million tons by 2025, we have to be visionary as to the level of crop development, genetic development, energy crops and forestry resources, land management and productivity,” Moore said. However, he added crop productivity has more than doubled in the past 25 years, so the task force believes that increasing state biomass production to 25 million tons of biomass by 2025 is a very realistic goal.
KY Corn Yield, 1950-2009, Projected to 2025

USDA-NASS. 2009. Crop Production Historical Track Records
US Corn Yield, 1950-2008, Projected to 2030

Yield (bu/ac) vs. Year

USDA-NASS. 2009. Crop Production Historical Track Records

2005-2030

+28%

+50%
KY Switchgrass Yields (Princeton)

Low-input switchgrass makes more efficient use of N, energy.
KY Hay Yield, 1950-2008, Projected to 2025

USDA-NASS. 2009. Crop Production Historical Track Records

USDA-NASS. 2009. Crop Production Historical Track Records

-22%
US Canola & Sunflower Yield Trend

- 10% increase by 2025
- 0.7-0.8 t/ac

Canola, 1991-2008 Projected to 2030

Sunflower, 1975-2008, Projected to 2030

USDA-NASS. 2009. Crop Production Historical Track Records
KY’s 2025 Plan for Dedicated Biofuel Feedstock Crops

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Needed ((10^6 \text{ ton}))</th>
<th>Yield (projected ton/ac)</th>
<th>Area ((10^6 \text{ ac}))</th>
<th>Proportion of KY Cropland (%)</th>
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</thead>
<tbody>
<tr>
<td>Corn</td>
<td>1.2</td>
<td>4.8</td>
<td>0.25</td>
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<td>Switchgrass</td>
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<td>Total</td>
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- 775 million gallons of biofuel
  - 8% of KY’s current petroleum use
  - 3% of KY’s current energy use
  - 25-75% renewable
  - Renewable contribution: < 2%

US energy consumption was 2.8% lower in 2008 than 2007; petroleum consumption fell 6.4% (BP, 2009)
Governor’s vision: Crop shift

- Less
  - Hay
  - Soybean
  - Winter wheat
- More
  - Switchgrass
  - Corn
  - Canola
Potential Problems

• Increase in corn/decrease in soybean
  – More corn after corn
  – More fertilizer needed, more disease, more pesticide, compromised yields

• Canola and sunflower
  – Little track record in KY
  – Both susceptible to *S. sclerotiorum*; proposed rotation will bring disease pressure

• Reduced hay, soybean, winter wheat
  – Reduced availability of feed and food

• Half million acres of new cropland needed
  – Lost biodiversity, soil quality
Conclusions

• Governor’s projected energy demand exceeds projections from established trends
  – Energy consumption is more likely to level off or decline than to increase by 40% by 2025

• Governor’s 2025 biofuel plan
  – Reduces fossil fuel demand by <2% (less than reduction achieved in 2008)
  – Requires 1.6 million acres of dedicated energy crops (17% of KY cropland)
  – Requires 0.5 million acres of new cropland and reduces area available for existing non-corn crops
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