Short Rotation Woody Crops Note Summary
Day 1 Break Out Session
August 1, 2006

Focus: Plan for the contribution of short rotation woody crops (SRWC) towards production of 60 billion gallons of transportation fuel by the year 2030.

Co-chairs
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Participants
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Facilitation approach and discussion

Mark Decot: We need to consider the whole list of approaches related to feedstock production, conversion technology, marketing, and implementation.

Short Rotation Woody Crops (SRWC) are not typically utilized for making transportation fuel, but are used for power via direct combustion and for paper production. With the rising commercial interest in making transportation fuel from SRWC, there have been programmed efforts that demonstrated success, such as DOE-supported Biofuel Feedstock Development Program linked to bioenergy in NY state (700 acres of willow planted—Volk)

Substitute money for time is not viable for forest industry. It takes time for crop development. To achieve the energy goal, the feedstock needs to be focused on fast-growing tree species. Southern pine will be the best option for meeting the near-term 2012 energy goal as the high amount of southern pine stock is already available. The thinning of southern pine plantations is currently used for pulp production. The

transportation fuel market will be the new opportunity for utilizing southern pine feedstock.

The economic value of producing transportation fuel from SRWC should be also considered. That is, if there is a favorable return-on-investment for establishing and growing such crops for transportation fuel production.

2012 goals are to: (1) increase the harvestable yield, (2) decrease the cost of production, and (3) increase carbon-hydrate content. We need to concentrate on conversion technology. The participants agreed that although further efforts in optimizing conversion technologies is one of the important issues in SRWC, the group felt that the majority of the participants' expertise was on feedstock production rather than conversion technologies.

Which biofuel offers greatest potential for cost competitive production from short rotation woody crops? (Vote Count)

Ethanol (8)
Diesel/Biodiesel (7)
Butanol (4)
Hydrogen(1)
Methane (1)
Syngas Alcohol (1)
Fischer-Tropsch (1)

Based on the vote count result, ethanol was ranked the first followed by diesel/biodiesel.

What are the relevant feedstocks for producing each biofuel cost competitively? (Vote Count)

For making *transportation fuel*, the most important feedstocks are:

Poplar (12)
Southern Pine (10)
Willow (10)
Eucalyptus (3)
Sycamore (2)
Sweet gums (1)
Black Locus (1)

Based on the vote count results, poplar was ranked the first followed by southern pine and willow for producing biofuel cost competitively

What is the best way to use these feedstocks to make the fuel (routes)?

Brief introduction of Conversion processes available for all of the resources:

(1) Thermo-chemical process: John Jechura
(2) Gasification (to F-T catalysis or Syngas fermentation): Robert Brown
(3) Fast Pyrolysis: Phillip Badger

The routes for producing a specific biofuel from a specific feedstock were not identified in this discussion. Participants addressed that choosing a feedstock limits the conversion technology that can be utilized, and the conversion technology is tied to the crop which will be regionalized.

Also, participants agreed that there was a need for identifying the best (Economically efficient) feedstock-to-route for each feedstock (i.e., identifying the conversion process given the mix of feedstocks).

What R&D activities will overcome the priority barriers?

R&D activities should be focused on optimizing production system and production cost (yield increase, breeding, etc…). To achieve this goal, the followings are high level research efforts to be realized:

- Harvest and Handling
  - » Harvesting and transportation equipment optimized for SRWC
  - » Optimized Harvesting, Transportation, and Storage Systems
  - » Infrastructure: Harvest→ Transport→Process

- Biology/Yield Improvement
  - » Yield increase

- Production Cost
  - » Reduced management cost
  - » Cost-competitive production
  - » Feedstock cost
  - » Decreased handling cost

- Crop Genetic Productivity
  - » Genetic Variation(disease risk)
  - » Crop diversity (poplar)
  - » R&D to alter cell wall composition and architecture (all feedstock crops)
  - » R&D to increase carbohydrate content (all feedstock crops)
  - » Biomass quality
  - » Genetic diversity of plant material
  - » Extractives in pine
  - » Geographically distributed feedstock availability
  - » Poplar selections for southeast

- Biological Sustainability
  - » Long term site productivity

- » Sustainability of production systems

Other needs:
Pest management
Conversion
-Suitable conversion process,
-biochemical vs. pyrolysis vs. thermochemical,
-small scale distributed conversion technology
-Non-fuel co-product value: Is lignin and hemicellulose better being converted to something else?
Socio-political land use issues
-Inability to use cisgenics/transgenics outside the lands
-Environmental impacts

<u>Solutions to the R&D barriers that were prioritized</u>

- Harvest and Handling
  - » Solution: Feedstock mix consistently available
  - » Low cost transport system

- Biology/Yield Improvement
  - » Effects of soils and climate on yield
  - » Field trials testing
  - » Eco-physiology of forest growth
  - » Site quality issue
  - » Integrated silvicultural regime

- Crop Genetic Productivity Enhancement
  Solution:
  - » National Breeding Centers
  - » Breeding/clone selection for site adaptability
  - » Best genotype or clone for bioenergy production
  - » Addressing constraints on productivity with modern genomic tools

- Biological Sustainability
  - » Long-term cause/effect research on productivity
  - » Nutrient Recycling
  - » Integrated Pest Management