



The Feedstock Supply Chain and Centers of Energy Excellence Update

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Key Issues

- Michigan is the 8th most energy intensive state
- Expend almost \$26 billion per year to import energy - 5% of our Gross State Product (reference year 2007)
- Michigan's economy is dependent on imported fossil fuels
 - 100% of coal and uranium used for power generation
 - 96% of transportation fuels
 - 75% of natural gas
- The Federal Government is moving towards a cap/trade or Carbon Tax
- Diversification of economy – MI is 17 times more dependent on Big 3 Jobs than any other State in the US.
- MI has lost approximately 400,000 manufacturing jobs in the last 6 years
- Cleantech industry growing at 20% plus per year with unmet demand



Bioeconomy Opportunities

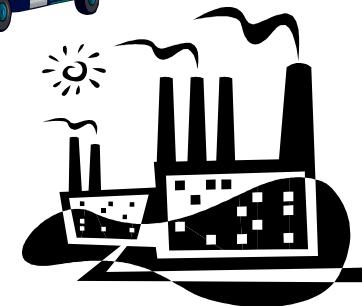
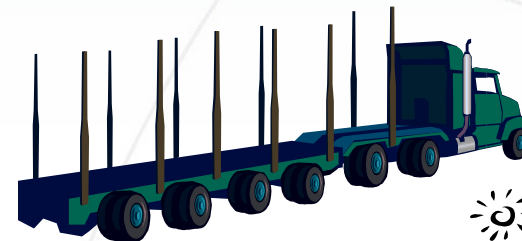
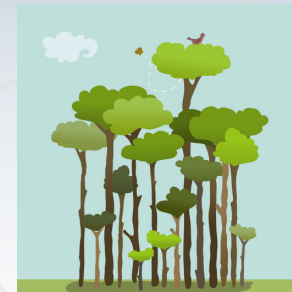
- Michigan has the 5th largest state timberland resource.
- Some forest, agricultural, and municipal woody biomass components are under-utilized (including waste/residue streams)
- Existing infrastructure utilizing and producing agricultural and forest-based woody biomass
- Potential for integrated manufacturing of the variety of forest (and non-forest) based biomass to generate highest value
- Proven technology for electricity, heat and steam





Challenges

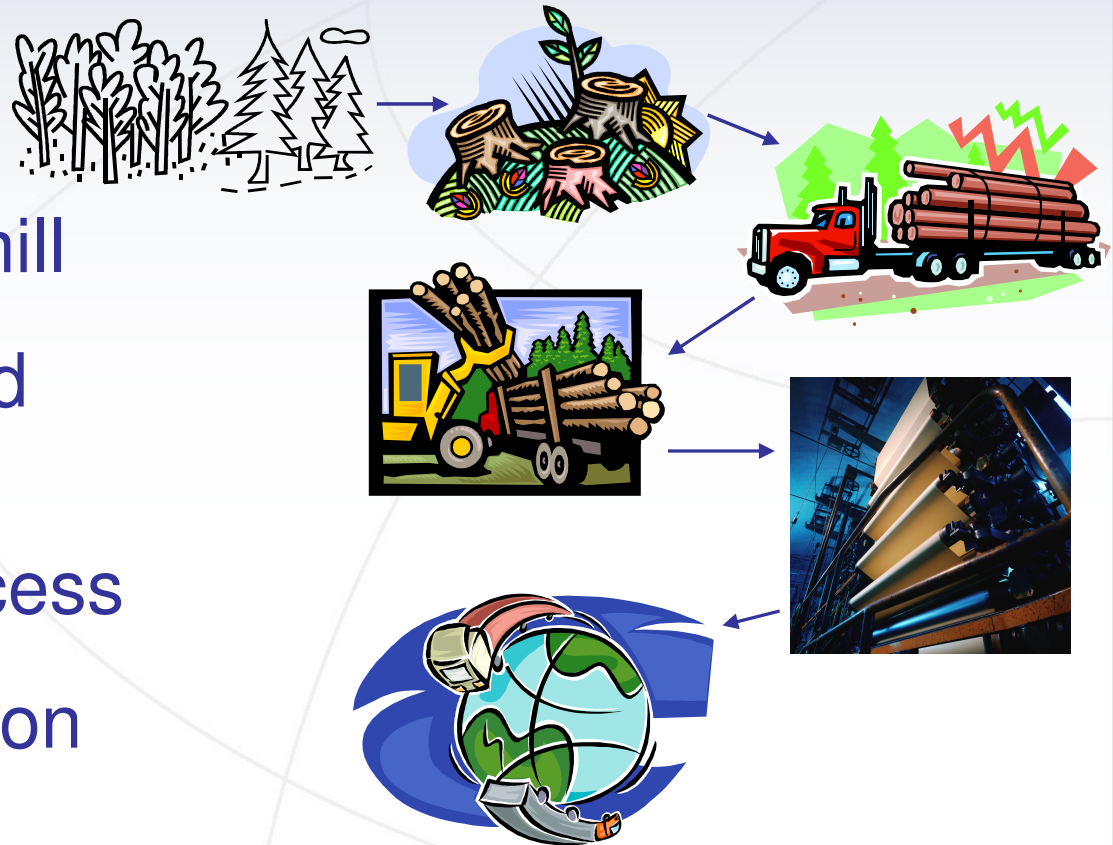
- Understanding feedstock/raw material availability and supply to support investor decisions
- Redesign of harvest and transportation technologies
- Developing manufacturing technology for liquid fuel production
- Competitiveness of new and existing woody biomass feedstock/raw material using businesses





Supply Chain Components

- Sustainable Supply
- Harvest
- Transportation to mill
- Wood receiving and processing
- Manufacturing process
- Sales and distribution





Examples of Biomass Sources

- Un-harvested annual above-ground growth on timberlands
- Logging residues
- Mill residues
- Energy crops (e.g. poplars, willows and perennial grasses)
- Agriculture residues
- Urban wood waste
- Municipal solid waste
- Biosolids from wastewater
- Food process waste
- Others...

... We have limited accessible databases quantifying inventory, availability, and supply (actual or potential) ...



State Energy Grant

(Issued through the Department of Labor and Economic Growth)

- Contracted with Michigan State University - spatially based inventory of the following biomass sources:
 - Idle land
 - Corn stover
 - Sugar beet pulp
 - Animal manure
 - Straw
 - Food process waste
 - Municipal solid waste
 - Biosolids from wastewater



Forest-Based Biomass Supply

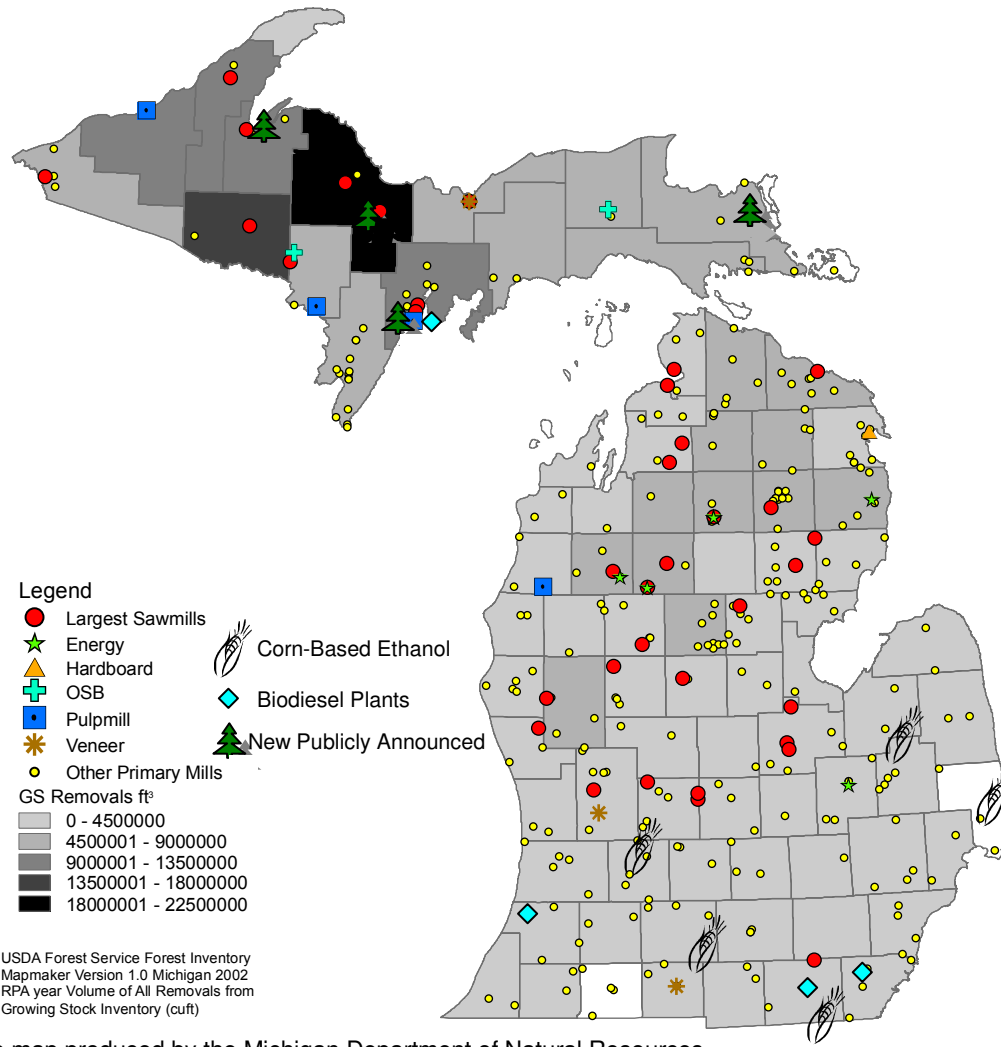
- Inventory
- Sustainable Management
Impacts on Availability
- Social Impacts on
Availability
- Supply: Economic
Impacts on Availability





Forest Product Primary Mills and Growing Stock Removals

With addition of operational corn-based ethanol plants, biodiesel plants
and new publicly announced renewable energy projects



Base map produced by the Michigan Department of Natural Resources

www.michigan.org

MICHIGAN ECONOMIC DEVELOPMENT CORPORATION



Statewide Forest-Based Biomass Assessment

- Development Forest-Based Information System in a spatial framework (GIS), with a user friendly interface that includes forest-based biomass inventory, current forest-based biomass availability, and an identification of constraints that limit availability
- An assessment of sustainable forest-based biomass availability and a definition of potential availability that could exist if constraints are relaxed thus giving the user an idea of where investments may be made to improve availability
- An assessment of the potential role that forest-based biomass can play in supporting the State's renewable energy goals while supporting existing forest-based biomass demand.

Finalizing funding for immediate implementation



Michigan Centers of Energy Excellence Program



Key Assets

- Key Anchor Companies
- Presence of OEMs
- Top manufacturing workforce
- Top wood fiber resource
- Top universities in key fields
- Sense of Urgency
- 21st Century Jobs Fund
- International relationships (Sweden, Israel, etc.)
- Existing relationship with key cleantech venture capital firms (Flagship, VantagePoint, Khosla, etc.)
- Fresh Water
- Outstanding Geological Formations for CO₂ Sequestration



MEDC Response – Cluster Based Economic Development

- Targeted industries
- Potential for significant growth
- Leverage state strengths
- Generally not mature
- Gap exists – requires economic assistance

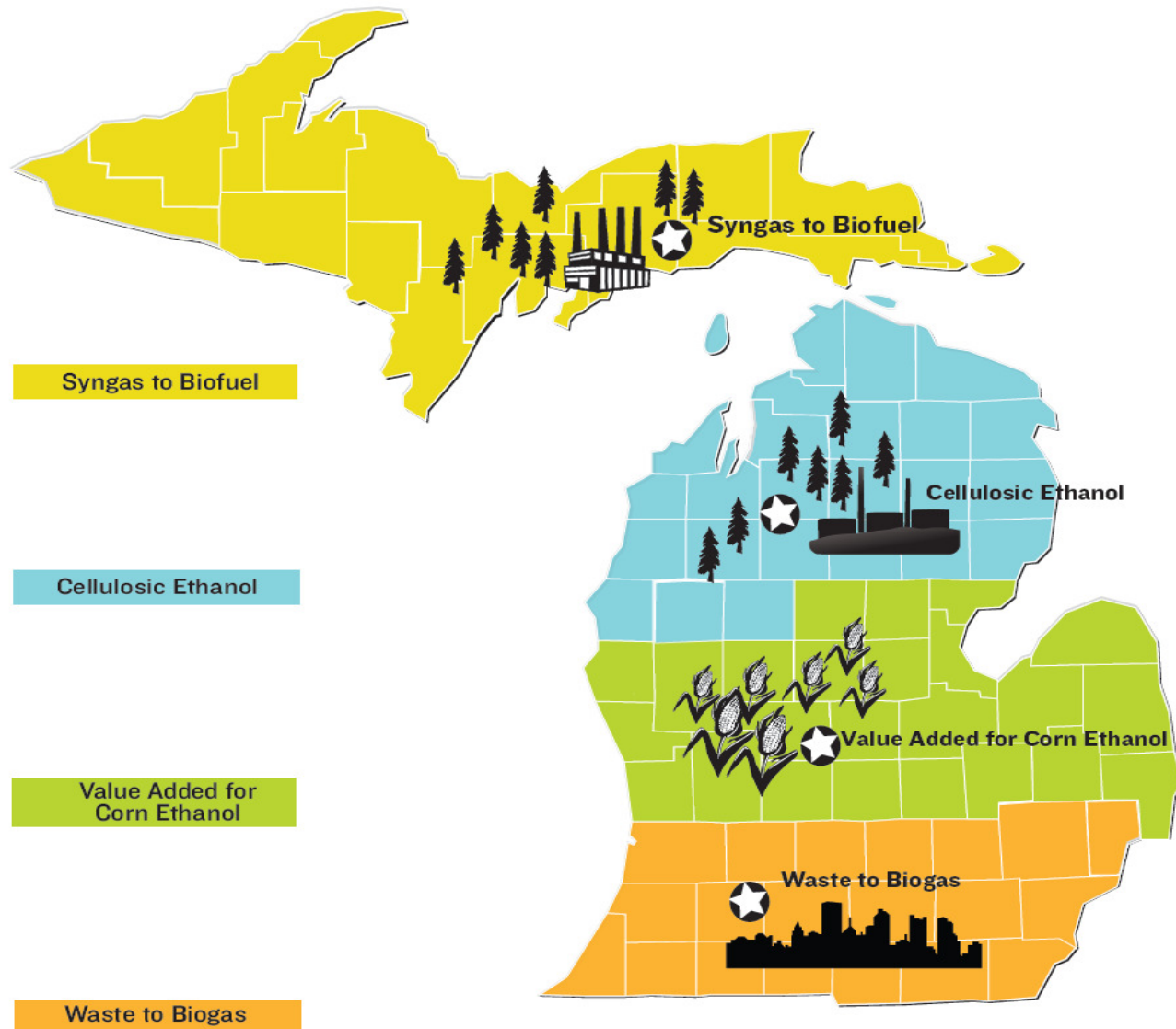
1. Wind Turbine Mfg.
2. Bioenergy/Fuels
3. Advanced Energy Storage
4. Solar/Photovoltaic
5. Water Technology
6. CO₂ Capture, Reuse & Sequestration



Cellulosic Biofuels

- **Target Focus:** Bio-fuel production using cellulosic biomass as feedstock (e.g., wood waste, energy crops, agriculture stover)
- **Data-Driven Research**
 - Michigan competitive advantages (forest products)
 - Related commercial/industrial expertise - pulp/paper mill industry
 - Relevant workforce in place
 - World class universities
- **Cluster Team** – Formed in 2007. Actively participated in the creation and implementation of a strategy.
 - **Potential focus areas across multiple technologies and regions.**
 - Gasification of Cellulosic Biomass to Motor Fuels
 - Biochemical Conversion of Cellulosic Biomass
 - Value-Added Products for Corn Ethanol Producers
 - Municipal Waste to Biogas/Motor Fuels

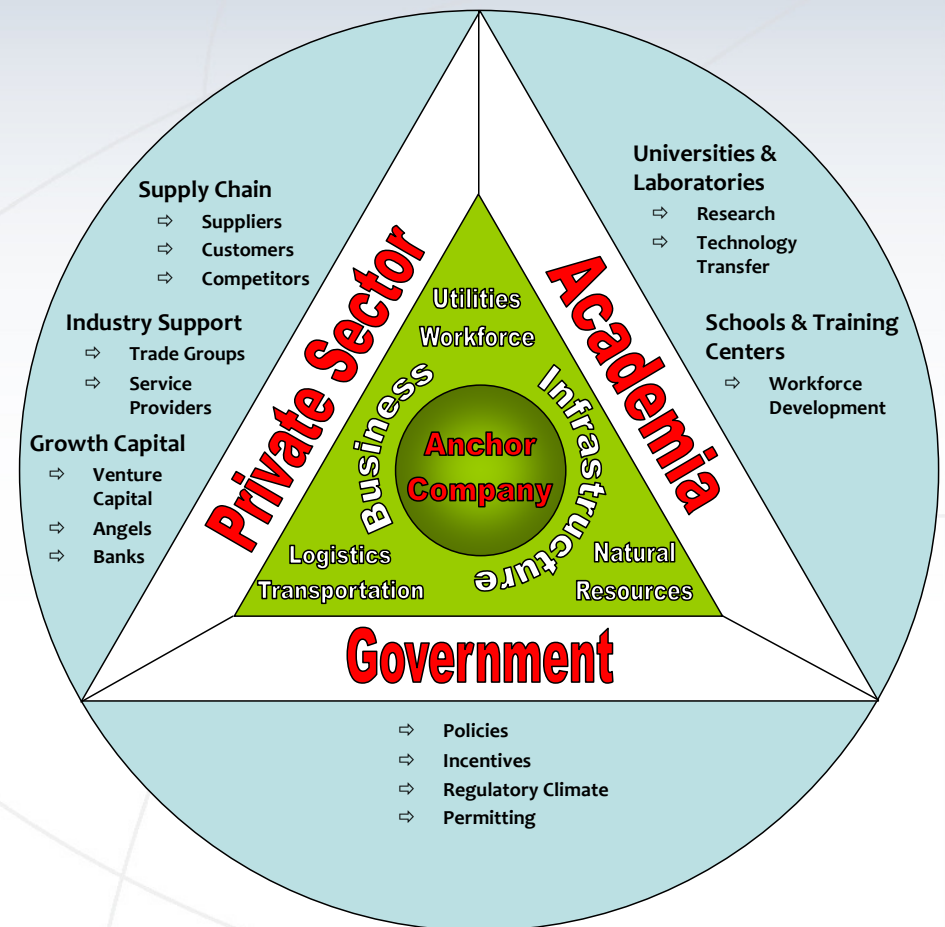
Biofuel Focus Areas





Centers of Energy Excellence

- Goal is to rapidly grow an industry cluster (energy security and environmental profile)
- Includes high profile anchor company at the center
- Geographically located in area with strong business infrastructure
- Surrounded by private sector companies, academic institutions, and government entities
- Assigned to areas where technical or supply chain issues limit commercialization
- Significant economic impact





SB 1380/PA 175 – Centers of Energy Excellence

- Michigan Strategic Fund (MSF) to create and operate a COEE Program to *promote the development, acceleration, and sustainability* of “energy excellence sectors” in Michigan.
- MSF board to *spend up to \$45 million* from the 21st Century Jobs Trust Fund appropriations
- *Only to for-profit companies.*
- Include *at least one institution of higher learning*
- Require at least *50% of the funds allocated for the Program be used to match* foundation funding, federal funding, or international investments.
- All funding allocated for 2007-2008 and 2008-2009 has been awarded and the program is currently suspended and not accepting further applications.



6 Centers Awarded

- **Swedish Biogas International Center of Energy Excellence in Waste to Energy**
 - Partners: Kettering University, City of Flint, Linkoping University (Sweden)
 - \$4 Million
- **SAKTI3 Center of Energy Excellence in Advanced Batteries**
 - Partners: University of Michigan, Ann Arbor SPARK
 - \$3 Million
- **A123 Center of Energy Excellence in Rechargeable Lithium Batteries**
 - Partners: University of Michigan, Michigan State University
 - \$10 Million
- **Working Bugs Center of Energy Excellence in Biorefineries for the Production of High Value Specialty Chemicals from Natural Feedstocks**
 - Partners: Michigan Technological University
 - \$2 Million
- **American Process, Inc. in Partnership with Valero Energy Center of Energy Excellence in Biobiorefinery Conversion of Process Waste Effluent into Cellulosic Ethanol, Sodium Acetate and Clean, Warm Water**
 - Partners: Michigan Technological University
 - \$4 Million



Six Centers Awarded

- **Mascoma Corporation Center of Energy Excellence in Cellulosic Ethanol**
 - Partners: JM Longyear, Michigan State University, Michigan Technological University
 - \$20 Million



Mascoma Feedstock Supply Chain Center of Energy Excellence

- \$2 Million of the Mascoma Center of Energy Excellence Grant is dedicated to improving wood biomass feedstock supply and the supply chain
- Frontier Renewable Resources, Michigan State University and Michigan Technological University
- Feedstock availability, harvest and transportation to develop overall supply chain efficiencies
- Development of technologies and tools
- Broader benefit



Feedstock Supply Chain COEE Project Areas

- Increasing Sustainable Biomass Feedstock Availability
- Improving Forest Feedstock Harvesting, Processing and Hauling Efficiencies
- Feedstock Supply Chain Modeling
- Outreach Extension and Technology Transfer



Can We Do It? Yes We Can.

