IPRO 349 Solid Fuel from Biomass for Cogeneration

PROBLEM

▪ Lack of an efficient conversion method for corn stover to usable energy via cogeneration

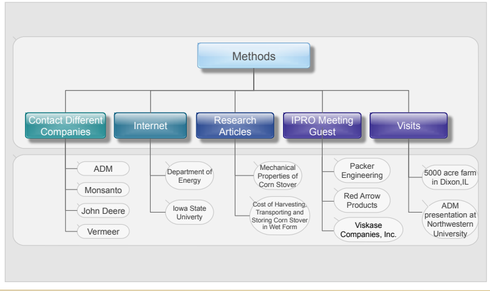
OBJECTIVE

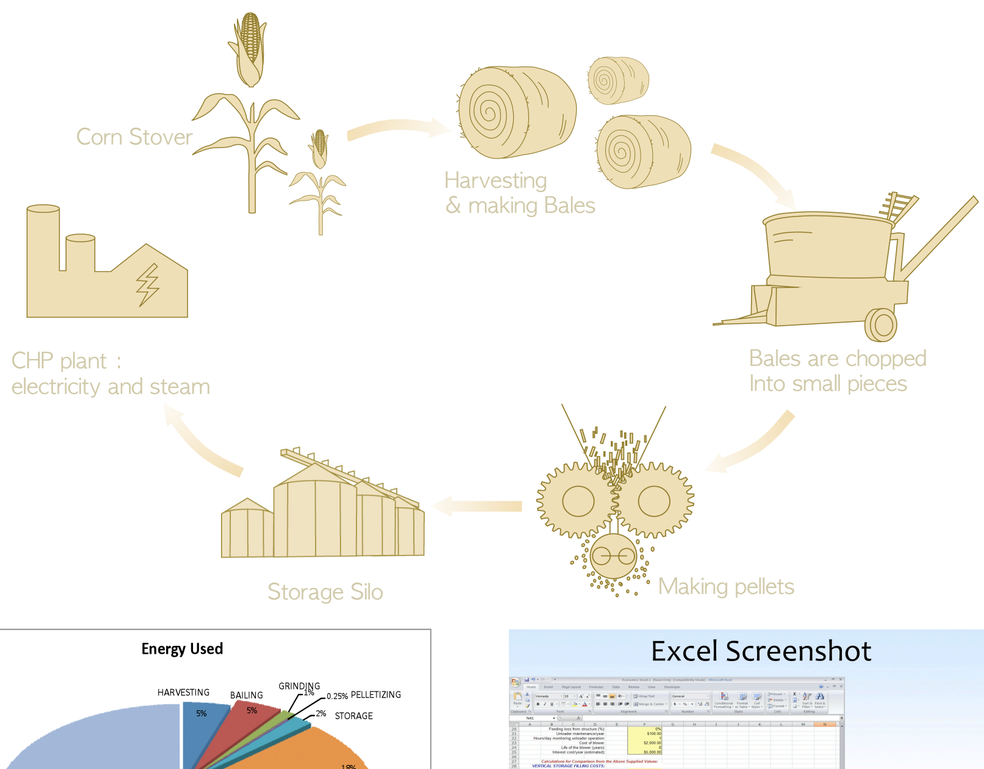
• Investigate pathways for small scale conversion of stover to usable thermal and electrical energy
• Develop a detailed system for a small scale CHP process
• Determine the cost and energy efficiency of each step of this system
• Research different tools, equipment, and processes to develop most energy, cost, and time efficient process
• Propose a possible test model

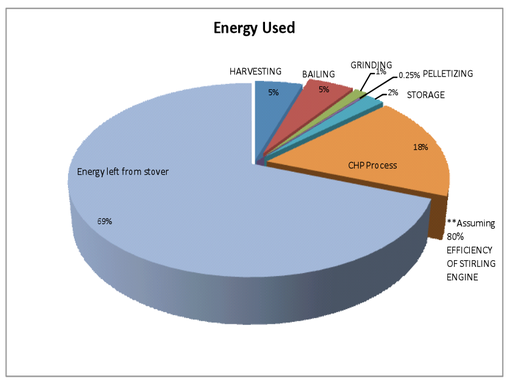
IMPORTANCE

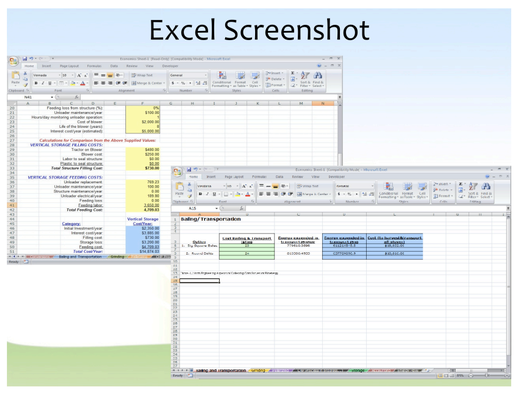
• The U.S. is moving towards sustainability
• Biomass is becoming popular, but the use of solid biomass as a direct energy source is relatively unexplored
• There is an increase in demand and a decline in production of natural gas
• Potential energy from stover is greater than that of natural gas, propane, and heating oil
• Places energy value on stover which was once considered waste

METHODOLOGY









RESULTS

Large Scale

BENEFITS
• Creates jobs
• Large localized facility
• Access more customers
• Gasification
: High energy yield
: Ease of transport /storage

DISADVANTAGES
• Complicated logistics
• Large investment
• More complicated process

Small Scale

BENEFITS
• Conventional
• Feasibility of experiment
• Nearly eliminates transportation issue
• Simpler equipment
• Smaller investment
• Farmer can sell extra electricity

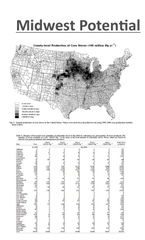
DISADVANTAGES
• May not be as efficient
• Chose not to use gasification in order to simplify

RESULTS

• If the farmer implements a system similar to our proposal, he will generate a net gain of 8.9* billion BTU's, which he is able to use for the farm and to sell back to the grid. This can be accomplished with a moderate initial investment of approximately $260,000 - $300,000*

MIDWEST POTENTIAL

Midwest Potential



State	Stover Production Million Metric tons	% of U.S. Total
Iowa	35.9	18.3
Illinois	31.0	15.8
Nebraska	23.5	12.0
Minnesota	19.4	9.9
Indiana	15.3	7.8
Ohio	9.0	4.6
Wisconsin	8.0	4.1
Kansas	8.0	4.1
Missouri	6.1	3.1
Michigan	5.1	2.6
10 State Total	**161.3**	**84.2**
U.S Total	**196.2**	**100**

Source : Graham et al. Agronomy J.99:1-11(2007)

Source: bioenergy.ornl.gov

TO-DO RECOMMENDATIONS

• Website and interactive database
• Look into gasification – energy is 9:1
• Nitrogen byproduct production
• Test models: small and large scale
• Piping of stover slurry for transport
• Specific equipment required for steam turbine

TEAM

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