DISCUSSION GUIDES

The following questions can be used to guide discussions about impacts of biomass production, harvest, processing, and conversion. There are three sets of questions: the first set aligns with the matrices for annual/perennial biomass, woody biomass, and corn grain ethanol. The second set of questions corresponds to the anaerobic digestion matrix. The third set of questions corresponds to the wind energy matrix.

Biomass (annual, perennial and woody)


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Biomass Production and Harvest: ENVIRONMENTAL QUESTIONS

Biodiversity conservation: How will biomass production and harvest activities impact plant species mix? How will biomass production and harvest activities impact wildlife habitat and food availability?

Soil nutrient depletion: How will biomass production and harvest activities impact nutrient availability and organic matter of soils? Will harvest activity cause compaction, erosion or run-off?

Soil health: How will harvesting activity change soil health? Consider ways that potential impacts to soil health can be mediated or buffered.

Water quality and quantity: How will biomass production and harvest activities impact groundwater or surface water quality or quantity?

Carbon sequestration: How will biomass production and harvest activities either reduce or increase the amount of carbon sequestration occurring from cropland? Consider the ways crops or residues are harvested, and ways to maximize sequestration.

Land use: How will biomass production and harvest activities impact the amount of land in agriculture, forest, or CRP land and the health of these lands?

Biomass Production and Harvest: ECONOMIC QUESTIONS

Direct start-up costs including technology and skill investments: Will growing or harvesting of biomass require specialized equipment? Will growers need new skills to manage agricultural lands, woodlots or forests for biomass?

Medium- and long-term profit potential: How long will it take for landowners/managers to realize a profit on their investment?

Economic risk – volatility of commodity market: Is volatility anticipated in the biomass market?

Impact on farmers – cost of learning and integrating new production practices: Will farmers need to learn new production, establishment, and harvesting practices? Will land management practices change? (e.g., rotations, buffer zones, integration of annual and perennial crops)

Impact on farmers – flexibility in land use and management: Once land is dedicated to biomass production, is the landowner committed to continue with that crop, management strategy or market?

Impact on crop commodity prices: Will increased production of biomass (specifically dedicated bioenergy crops) affect prices of other crops?

Impact on other farmers: How will demand for biomass affect the supply of food, fiber, or feed? Will grazing lands be converted to growing dedicated bioenergy crops? What impact will this have on farmers who rent land for grazing?

Impacts on land purchase prices: How will increased demand for biomass affect land prices?

Availability of federal/state incentives: Are there federal or state incentives (e.g., BCAP or similar programs) that make dedicating land to biomass for energy production economically feasible?

Other economic factors of biomass production: Are there any local or regional potential economic impacts of producing biomass for energy production that have not yet been considered?

Impacts on existing forest product industries: How will demand for biomass energy production affect forest product industries in the region?

Impact of landowner economic security on community: How will potential improvement in economic security of landowners affect the community?

Biomass Production and Harvest: SOCIAL QUESTIONS

Land use changes (cultural, historical, neighborhood considerations): Will increased production and harvesting of biomass affect the landscape and people's relationship to the landscape?

Impact on community character: Are there potential conflicts around the use of agricultural lands, forests or woodlots for biomass for energy production?

Contributions toward sustainability/energy independence: How will growing or harvesting biomass for energy production contribute to the community's goal of reducing imports of energy (fuel or electricity)? How will growing or harvesting biomass for energy production contribute to the community's goal of reducing greenhouse gases?

Distribution of benefits among participating landowners: Is the benefit equitable among participating landowners?

Distribution of benefits to the community: How will the non-farming community and non-land owning community benefit from changing land use practices associated with growing biomass for energy production?

Biomass Processing and Conversion: ENVIRONMENTAL QUESTIONS

Impact on wetlands, forests, and other natural assets: How will biomass processing and conversion affect wetlands, forests, and other natural assets, including ground and surface water?

Traffic, additional road construction: How will biomass processing and conversion affect traffic, road construction and conditions, and rail use?

Water quality and quantity: How will biomass processing and conversion affect municipal water systems? Can resulting grey water be recycled? Will water used in a production process be pre-treated before discharge? Where will waste water be discharged?

Waste storage, processing, and disposal: How are waste products from biomass processing and conversion processed? Will these be recycled? Can by-products such as ash be used?

Air quality: Will biomass processing and conversion emit any particulate matter, dust, or other emissions that could affect human or animal health? What permitting applications are necessary? Will the industry use smokestack scrubbers?

Spread of disease/pests: Will biomass processing and conversion contribute to the spread, or mitigation of the spread, of undesired tree-borne diseases or pests?

Odors: Will biomass processing and conversion emit dangerous or unpleasant odors?

Noise: Will there be any significant increase or change in noise from biomass processing and conversion?

GHG emissions: Will biomass processing and conversion produce additional greenhouse gas emissions (from the transportation and processing/burning activities)?

Energy use – potential for conservation or cogeneration: Does the facility offer potential for conservation or co-generation? What will the energy balance of electrical production be? When feedstock production is considered, what is the life cycle analysis for energy use for producing energy from biomass feedstock?

Biomass Processing and Conversion: ECONOMIC QUESTIONS

Job creation and employment characteristics: (a) Existing job retention and creation: How will biomass processing and conversion affect the retention of existing jobs and the creation of new jobs? (b) Short-term versus long-term job creation: Will jobs created be short-term (e.g., construction) or long-term (e.g. new businesses for pellet furnaces, pelleting, trucking, facility operation, etc.)?

Effect on local labor market including wages, benefits: How will new jobs from biomass processing and conversion affect the local labor market? Are the jobs likely to be paying high, living, or low wages?

Direct economic impact: How will biomass processing and conversion affect community economic development (job creation, increased spending, induced economic effect)?

Secondary and induced economic impact: How will biomass processing and conversion affect demand for other local business goods and services? Will spending for biomass refining increase the number of dollars circulated locally? Is the community well-positioned to capture new markets that a bioenergy industry might present? Will increases in the number of jobs be met with increased economic security, earning power, and household expenditures of the labor force?

Profits/risks for local investors: If a biomass processing and conversion industry is financed by local investment capital, how risky is the investment? What mechanisms are in place to assure that investments can be recouped if the facility is not built or not operational? Is this level of risk healthy for the community?

Risk of adequate supply of biomass feedstock: Is there risk of inadequate supply of feedstock or temporary disruption of feedstock availability? Could the plant shut down or slow down for this reason? How would this affect the community? What backup feedstocks exist?

Impact on local economic development plans: Does the biomass processing and conversion facility fit with local economic development plans? Will the community need to reevaluate its development plans?

Impact on existing businesses: Will the biomass processing and conversion facility have any effect (negative or positive) on existing businesses? Is there potential for conflict?

Impact on tourism and recreational industries: Will the biomass processing and conversion facility affect recreational industries, due to the aesthetics of the plant, air quality, truck traffic, or other variables?

Changes in workforce development needs: How will job creation affect work force training or retraining needs?

Biomass Processing and Conversion: SOCIAL QUESTIONS

Community decision making – changes in cohesion and conflict: How will biomass processing and conversion affect community cohesion? Will discussion, negotiation, and/or conflict have any effect on community character, cohesiveness, inclusivity, and/or social capital?

Demand for increased community services: How will changes in employment patterns affect demand for social services (schools, health care, translation, emergency services)? Does the community have the capacity to deliver these services?

Worker health effects/risks: How will biomass processing and conversion industries affect worker health (e.g., through emissions, exposure to hazardous substances, dangerous work assignments)?

Traffic patterns and impact: How will biomass processing and conversion affect traffic patterns and demand for road construction/maintenance?

Demand for emergency response capability: How will a biomass processing and conversion affect emergency response capacity? Are there risks of fire or hazardous spills?

Impact on sewerage services: Will waste water or other effluents drain into the sewerage system? Can the system handle such an increase? Will biomass processing and conversion facilities have storm water management plans?

Noise impact: Will biomass processing and conversion facilities cause any noise disturbance?

Air quality, dust particles, emissions: Are there emissions associated with biomass processing and conversion facilities? Have the developers taken care of necessary permitting applications? Will the industry use smokestack scrubbers?

Quality of life impact: How will biomass processing and conversion facilities affect the quality of life for community residents?

Impact on community character: How will biomass processing and conversion facilities affect the landscape or sense of community? How will siting of facilities affect neighborhood aesthetics, neighboring institutions, facilities or operations, and property values?

Changes in local tax base and land prices: What tax revenue might biomass processing and conversion bring in? Will land prices change?

Cost to community (incentives, infrastructure development): Are biomass processing and conversion industries eligible for TIF financing? Is the community being asked to supply services (water, sewerage, other) or to develop additional infrastructure?

Anaerobic Digestion


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TERMS: ***Biogas*** = gas produced by the biological breakdown of organic matter through anaerobic digestion. ***Digestate*** = the material remaining after anaerobic digestion of feedstock. Digestate is separated into solids (fiber) and filtrate (effluent). Digestate may be composted, used as animal bedding material, or pelletized for fertilizer. ***Filtrate, effluent*** = the nutrient-rich liquid by-product of the anaerobic digestion process.

Biomass 'Collection' and Facility Operation: ENVIRONMENTAL QUESTIONS

Soil nutrient balance (including issues of phosphorus and nitrogen segregation and displacement): How will phosphorus be removed from the digestate? What is the plan for phosphorous (sale as fertilizer, export to other fields)? What by-products of the anaerobic digestion process will be returned to the soil (e.g., effluent, fiber, compost)? How will effluent be applied? Is there adequate land for spreading effluent? How will land managers assure adequate crop nutrition without excess nutrients?

Soil health: How will the diversion of manure for energy production, and changes in manure management and spreading, affect soil health? Will digestate be applied to fields, be used for bedding, or be exported out of the region? Will digestate be pre-treated before application to soils (e.g., composting to convert ammonia into organic, more stable forms of nitrogen)?

Water quality and quantity: How will the digester affect water quality and quantity? Will any increases in regional stocking rate of animal units affect water quality? Will effluent be pretreated to reduce levels of biochemical oxygen demand (BOD) and chemical oxygen demand (COD)?

Air emissions, air quality, odors: Will the digester cause odors? Are there air quality issues that must be addressed with use of the digester? What emission control technologies will be implemented to control for nitrogen oxide gas? How will ammonium be managed?

Greenhouse gas emissions: How will the digester affect greenhouse gas emissions? Will any increases in regional stocking rate of animal units lead to increased GHGs?

Energy use: What energy sources are needed to operate the digester? Are there opportunities for using heat from the process for combined heat and power benefits?

Noise: Will the digester cause noise and create a nuisance? Will there be noise associated with transport requirements for moving manure into a facility, and by-products off the facility?

By-product disposal, processing: How is digestate being processed? What are digestate treatment options (addition of polymers, composting, other)?

Biomass 'Collection' and Facility Operation: ECONOMIC QUESTIONS

Start-up costs for farmers and community members: What are the costs to a farmer or community to establish an anaerobic digester, and for associated infrastructure? Who will bear these costs? Will farmers need to scale up their operations to make the facility cost-effective?

Medium- and long-term profit potential: How long will it take owners to realize a profit on their investment in the facility? Are banks receptive to financing these operations?

Economic risk – volatility of commodity market: Are there nearby markets for the biogas? Are these markets high value and stable? When dealing with utilities, will the utilities honor contracts for biogas at agreed upon rates when production is increased? Are there plans in place for generating added value from separated manure fiber? Is there potential to earn revenue by charging tipping fees for accepting off-farm food processing wastes?

Impact on farmers, flexibility in land use and management: Once a farm operation decides to operate an anaerobic digester, will the farmer be locked into a particular management strategy? Will this create a hardship for landowners?

Long term economics of facility construction and operation: Has the cost of long-term operation been factored into the anticipated payback schedule? What staffing will be required?

Impact on land purchase/rental prices: How will the digester affect land values? Are there land availability issues that must be taken into account (e.g., land available for spreading or application of digestate)?

Impact on farm structure/size: Does the digester technology necessitate scaling up the farm operation and/or adding animal units? Do farmers have the economic capacity to expand, or the possibility of procuring loans for expansion? Do farmers have the management capacity to operate the digester and large-scale farm operations?

Community economic impact – jobs and additional spending: Will the construction and operation of the anaerobic digester support new jobs, and at what wage structure? How will new jobs (either short-term or long-term) affect the community? Are any indirect economic benefits anticipated, such as increased spending in the community?

Community economic impact – changes in workforce development needs: How will changes in employment patterns (new jobs) affect demands for training or retraining the work force?

Biomass 'Collection' and Facility Operation: SOCIAL QUESTIONS (Matrix 1, farm-level impacts)

Landscape changes – aesthetics: Will the anaerobic digestion facility have a significant affect on the landscape and people's relationship to the landscape?

Landscape changes – equity and distribution of costs/benefits: In the case of community digesters, how are costs/benefits distributed for participating farmers? Are the benefits distributed to the entire community or to a smaller sub-set of the community? Are the landscape changes borne by the entire community or a smaller sub-set of the community?

Landscape changes – sense of community and identity of community: Will anaerobic digesters change the community's identity? Will farms and farmers take on a different role? Will the change to a more industrialized farmstead change residents' perceptions of farm life?

Farmer livelihood – impact on community: How will potential improvement in economic security of farmers affect the community as a whole?

Impact on farm structure/size: Does the digester technology privilege one size or structure of operation over others? Will the availability of incentives and/or technology privilege one size or structure of operation over others?

New management practices: Will farmers have access to training to safely operate digesters?

Supply chain issues: How will anaerobic digestion facilities affect supplies of farm inputs? How will by-products of the digestion process impact other farms?

Equity of access: Is the anaerobic digestion technology available to all producers? Can Extension train operators of digesters of various scales in safe operating procedures? Do all farm operators and/or digester operators have access to information about effective and safe digester operation?

Biomass 'Collection' and Facility Operation: SOCIAL QUESTIONS (Matrix 2, community-level impacts)

Community decision making – changes in cohesion and conflict: Will an anaerobic digester affect community cohesion? Is there potential for conflict around the facility?

Changes in labor force – community services (schools, health care): How will changes in employment patterns (new jobs) affect demand for social services (schools, health care, translation, emergency services)? Does the community have the capacity to deliver these services?

Changes in need for emergency response capacity: How will anaerobic digesters affect community emergency response capacity and infrastructure?

Impact of road construction and maintenance: If new roads (or pipelines) are required, does the community have a plan to minimize disruption caused by construction?

Impact on sewerage services: Are any additional sewerage services required due to the digester? Is the municipality responsible? Is the industry responsible? What regulations are in place guiding sewerage systems?

Siting issues – impact on quality of life: How will residents be affected by the siting of the facility? Will there be any changes in noise, air pollution, dust, or other nuisances in the vicinity of the digester?

Transportation changes – impact on quality of life: How will collection, aggregation, and transport of materials have an affect on traffic patterns and roads? Will increased traffic affect some residents disproportionately?

Impact of related infrastructure development: How will the creation of supporting infrastructure affect neighbors and community residents? Could the siting of a facility be contentious due to neighboring institutions, facilities or operations?

Cost to community (incentives, infrastructure development): Will the community/municipality incur any of the costs associated with facility or infrastructure development? Where will the financing come from (e.g., increased taxes)? How equitable is the distribution of costs for the development? Can the community bear anticipated and unanticipated costs (e.g., if cost of facility development is greater than anticipated)? Is the project eligible for TIF financing? Will the community be asked to supply services (water, sewerage, other) or to develop additional infrastructure?

Changes to tax base: Will there be economic benefits accrued to the community through increased tax revenue from the business operating the digester?

Federal/state economic incentive programs: Are there federal or state incentives available that improve the economic feasibility of the anaerobic digester?

Wind Energy


Jeffrey J. Strobel

Wind Tower and Transmission Line Siting and Construction: ENVIRONMENTAL QUESTIONS

Changes in land use for property owner and at regional scale: How will the siting and construction of wind turbines and transmission lines affect land use for individual property owners? How will a transmission line affect land use at the regional scale? Will these effects be short-term (during construction) or long-term (continuous during operation)?

Soil health: Will construction activities cause compaction, erosion, or run-off? Are there any long-term soil health issues? Consider ways that potential effects on soil health can be mediated or buffered.

Fragmentation of land: Will the siting and construction of wind turbines and transmission lines cause fragmentation of land that could lead to a more limited habitat and range, or a restriction of movement for species? Can detrimental effects be mitigated (e.g., habitat corridors, change in siting)?

Biodiversity conservation: Are the wind turbines sited in zones where birds are likely to fly during migration? How will transmission lines affect animal species well-being? Are there other anticipated effects on plant or animal species mix, wildlife habitat and food availability, or prevalence of invasive or pest populations?

Water quality and quantity – impact on wetlands, hydrology: How will the siting and construction of wind turbines and transmission lines affect wetlands or affect hydrology (temporarily, due to construction or permanently, due to siting)? Will construction activities cause water run-off to waterways? Note the different effects of transmission line construction on different regions, across the length of the line.

Wind Tower and Transmission Line Siting and Construction: ECONOMIC QUESTIONS

Direct start-up costs for land owners: What costs will be incurred by the landowner in construction of wind turbines or transmission lines? How will loss of revenue from agricultural fields during the construction phase be offset?

Availability of viable power company that will buy energy: Prior to entering into agreements to lease or sell land for construction of wind turbines or transmission lines, have landowners assured that the electricity generated will be purchased by a viable power company?

Impact on landowners – loss of land in production: How will development of wind turbines and/or transmission lines affect income potential from agriculture? Will the arrangements with turbine owners/ power generators assure long-term income potential?

Impact on landowners – flexibility in land use and management: How will wind turbines and/or transmission lines affect land management strategies?

Impact on existing businesses/farms – profitability: How will the development of wind turbines and/or transmission lines economically affect local businesses and farms? Will power from wind turbines be made available to the community or exported out of the area?

Cost of transmission line and effect on consumer utility rates: How will the costs of developing new transmission lines be covered? Will consumer utility rates go up? Will state and federal incentive programs defray some of the costs?

Direct economic impact – jobs: How will new construction jobs affect the local community? Is the community prepared to train the workforce in jobs related to a green economy, such as turbine installation and maintenance?

Indirect economic impact – additional spending in the community: How will new construction and installation jobs associated with wind energy affect spending in the community and demand for other goods and services?

Wind Tower and Transmission Line Siting and Construction: SOCIAL QUESTIONS

Siting issues – impact on quality of life (e.g. noise, disturbance): Will the siting and construction of wind turbines and transmission lines cause noise or disturbance, as perceived by neighbors and other residents?

Landscape changes – sense of community and aesthetics: On a landscape level, how will the siting and construction of wind turbines and transmission lines affect the landscape and people's relationship to the landscape?

Appropriateness of public subsidies: Are residents in agreement about the appropriateness and use of public subsidies for development of wind energy?

Community decision making – changes in cohesion and conflict: Are there potential conflicts around the use of agricultural land or public lands for siting wind turbines? Will discussion, negotiation, and/or conflict have any impact on community character, cohesiveness, inclusivity, and/or social capital?

Community understanding of development process – transparency: Do landowners have access to information about the development process? Are all those individuals affected included in decision making regarding siting of facilities and transmission lines, and able to understand contract arrangements? How can residents assure transparency in the workings of the wind turbine operators and electric utilities?

Equity – distribution of costs and benefits: How are the costs and benefits of wind turbine and transmission line construction distributed (to landowners and to other community residents)?

Equity – land contract terms (lease agreement, sale, and easements): How are contracts being negotiated? Are contracts being negotiated equitably and transparently?

Neighbors' willingness to grant access – power lines, easements: To what extent is the ability of participating landowners to generate a consistent power supply contingent on neighbors honoring wind easements? If so, are neighbors willing to enter into such agreements, and abide by them? Will neighbors be asked to grant access for power lines, and if so, under what conditions?

Federal/state economic incentive programs: Are there federal or state incentives that make dedicating land to wind turbine and transmission line construction economically feasible for landowners? Or are incentives tied up with the electricity generator or commission?

Wind Tower and Transmission Line Operations: ENVIRONMENTAL QUESTIONS

Changes in use of agricultural and forest land – impact on field contiguity: How will the operation of wind turbines affect contiguity of agricultural and forest lands? How will fragmentation and loss of field and forest contiguity affect species range and migration and/or hydrology?

Fragmentation of land – impact on farming practices: Will the operation of wind turbines and transmission lines influence agricultural and forest land management? What lands will be taken out of agricultural production? Will any loss of production be offset with improved revenue to landowners? Will any loss of production affect the agricultural enterprise of the area?

Impact on migratory bird populations: How will the operation of wind turbines and transmission lines affect migratory bird populations?

Impact on other wildlife (biodiversity, population size): How will the operation of wind turbines and transmission lines affect biodiversity and population size of flora and fauna (in ways other than those mentioned) for construction of the lines? Are there ways to mitigate potential negative effects on flora and fauna?

Impact on GHG emissions (CO_2 and N_2O): How will the operation of wind turbines impact greenhouse gas emissions? How much energy can be generated for the benefit of the locality, the region (thereby offsetting GHG emissions from other sources)?

Impact of herbicide use – transmission line rights of way: What management practices are anticipated in the maintenance of the transmission line (mowing, herbicide use, and other practices)? How will these practices affect farms, wildlife, and flora?

Health concerns – impact on humans and animals: How will the operation of wind turbines and transmission lines affect human and animal health? How will potential stray voltage be monitored and managed? How will safety considerations for maintenance and operation of the turbines be incorporated into standard operating procedures?

Wind Tower and Transmission Line Operations: ECONOMIC QUESTIONS

Direct and indirect economic impact (maintenance, operation): How will the operation of wind turbine(s) impact the economics of the community (e.g., long term job creation, increased spending within the community)?

Medium- and long-term profit potential for landowner: Will the landowner continue to benefit, over time, from leasing or sale of land for wind turbines or transmission lines, or from the operation of the turbine and sale of power to the utility? Does the contract arrangement allow the landowner a percentage of the profits from power generated? What are the terms of the contract for medium- and long-term profit potential, and for renegotiation of the lease?

Changing dynamics of wind markets: As the renewable energy market matures, will wind power remain economically viable? Is the anticipated long-term market for sales of electricity generated by wind power stable and reliable?

Risk management impact: How will risk in energy markets be mitigated? What assurances will the landowner and community have that the long-term investment will be operational and profitable into the future? What mechanisms are in place to mitigate risk associated with the long-term viability of the wind turbine operating company and electricity provider?

Quality, quantity of electricity available for businesses, residents: Will the electricity generated be available to the community at affordable rates? Is the service reliable and consistent? What mechanisms are in place to store electricity during times of surplus wind and minimal demand, and to make it available during times of peak demand?

Equity of power purchase agreements: How are power purchase agreements negotiated with individual landowners/wind turbine operators? Are the contracting arrangements transparent and equitable? Is the utility willing to negotiate collective bargaining on contracts?

Long-term costs of equipment maintenance: Who will bear the costs of long-term maintenance and operation of the turbines (e.g. landowner, utility, community)? Have long-term equipment maintenance costs been factored in to the feasibility plan?

Wind Tower and Transmission Line Operations: SOCIAL QUESTIONS

Energy independence and energy security: How will the operation of the wind turbines contribute to energy independence goals? Will the community gain in energy security due to operation of wind turbines and/or sale of electricity to a utility?

Community decision making – changes in cohesion and conflict: Are there potential conflicts around the operation of wind turbines? Will discussion, negotiation, and/or conflict have any effect on community character, cohesiveness, inclusivity, and/or social capital?

Equity – distribution of costs and benefits (medium-/long-term): How are the costs and benefits of wind turbine and transmission line operations distributed (to landowners and to other community residents)?

Equity – does the 'wind shadow' prevent neighbors from developing future projects?: Are landowners who do not site wind turbines on their land during an initial phase of wind development precluded from siting wind turbines on their property in the future, due to the wind shadow that results from operation of a turbine?

Impact on future development patterns – ability to support other assets for economic development (for example, tourism): How will the operation of wind turbines affect future economic development? How might the wind turbines support community goals for auxiliary economic development? How will the operation of wind turbines affect recreational industries?

Neighbor agreement: Are neighbors willing to grant access for power lines, and honor wind easements? Are neighbors willing to grant access for maintenance and enhancement of turbines and power lines? Have long-term wind easement arrangements been worked into contracts with neighbors who control access?

Federal/state economic incentive programs – stability, changes in policy: Is the economic viability of wind power dependent on federal or state incentive programs? Are these incentives likely to continue? Are incentives necessary beyond the start-up phase?