Uncertainties in the Sustainability of Bioenergy Futures

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Four key categories of uncertainty

1. What is the problem that bioenergy confronts?
2. What do sustainable bioenergy systems look like?
3. What does social sustainability mean?
4. How can large-scale socio-bioenergy transformations be governed?

1. What is the problem that bioenergy confronts?

The IPCC estimates that the US would need to reduce its overall CO2 emissions by 80% or more in order to stabilize atmospheric concentrations at relatively safe levels.

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Ford research suggests that 75% of the necessary CO2 reductions from the passenger fleet could be met by plug-in hybrid electric vehicles with little to no change in driving habits.

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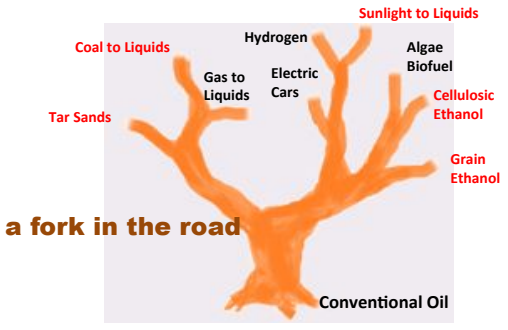

1. What is the problem that bioenergy confronts?

- How much stored fuel energy will we need? For what purposes? How much of this must be carbon-neutral?
- What alternative technologies will arise to challenge the role of biofuel: carbon sequestration, direct photochemical conversion, hydrogen fuel cells?
- How fast will we need to develop large-scale bioenergy systems?
- Can bioenergy systems compete?

2. What will sustainable bioenergy systems look like?

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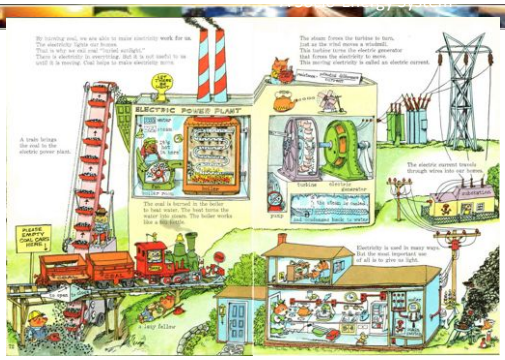


2. What will sustainable bioenergy systems look like?

Complex Socio-Energy-Environment Systems

GMOs
Soils
Run-off
Water
Land
Food
Agriculture
Farmers
Labor
Law
Activists
Regulation
Spills
Explosions
Air, Road, and Water Transportation
Refineries
Pipelines
Chemical Processing
Gas Stations
Scale of Operations
Supply Chains
Markets
Values
Vehicle Engines
Distribution
Highways
Consumption
Suburbs
Highway Repair
Rights
Behaviors
Forms of Living and Livelihood

Energy (and especially fuel) systems are the single largest human enterprise on the planet.

Energy is at the heart of modern industrial political economies

9 or the 12 largest companies in the world are in energy and the 10th is cars

2. What will sustainable bioenergy systems look like?

- What will be required, functionally and in terms of resources, to sustain these systems? What will their total life cycle impacts? How will they shape global supply chains?
- How can their consistency with the sustained functioning of ecological, economic, and social systems be guaranteed?
- What will the geographies of these systems look like?
- How will bioenergy economies fit into larger economies of production and consumption?
- What hazards, risks, failure modes, etc., will be characteristic of bioenergy systems?
- What analogous systems (food, blood products, oil, etc.) can help illuminate these questions?

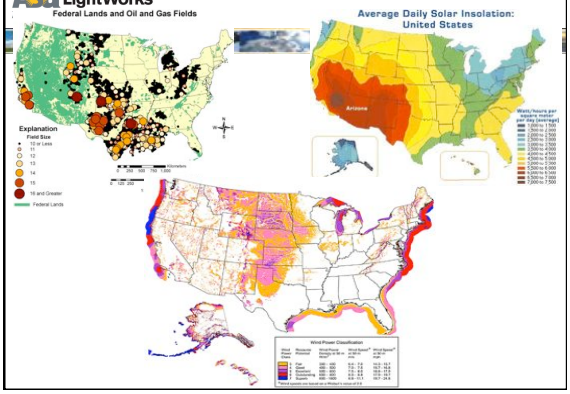
3. What does social sustainability mean?

How can bioenergy contribute to human thriving?

3. What does social sustainability mean?

- What are the requirements for human resources, skilled workforces, etc., required to sustain bioenergy?
- How must humans be (re-)disciplined in order for bioenergy systems to thrive? Will this be tolerable or desirable?
- What forms of political economy and social structure are implicated in bioenergy systems? Are these tolerable or desirable?
- How will publics, farmers, laborers, land owners, and other stakeholders be convinced of the value and significance of bioenergy? What trade-offs will they be forced to accept?
- Who will inhabit bioenergy futures? How well will they do so? What will their lives and livelihoods look like? Will they (all) thrive?
- How will the costs and benefits of bioenergy systems be distributed across individuals and groups? Will this distribution be just?

4. How will bioenergy transitions be governed?



4. How will bioenergy transitions be governed?

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- What challenges will bioenergy transitions pose for public administration, law, regulation, and governance?
- How can bioenergy transitions be initiated? How will the process be managed and administered? What human outcomes will flow from the transition, for whom, and with what ability to adapt and adjust along the way?
- How will a bioenergy transition redistribute wealth and power in local and global societies? With what social, political, and economic consequences, for whom? How will trade-offs be identified, negotiated, adjudicated, or imposed?
- What will a bioenergy transition mean for values, relationships, institutions, cultures, or other social arrangements that individuals and communities hold dear?
- Who will mobilize around bioenergy, why, and to what effect?

4. How will bioenergy transitions be governed?

- Is it possible to plan changes in highly complex systems that tightly intertwine human and technological elements?
- How can agencies effectively plan across a wide range of jurisdictions at multiple scales on a consistent and ongoing basis?
- Can existing institutions for regulating energy systems be reformed to facilitate long-term planning?
- Can we design bioenergy transitions so that they generate less disruption and dislocation, greater equity and equality, more justice, and improved human lives and livelihoods—rather than the reverse?


What are the real choices we have? Will we have the courage to take them?
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