Lessons Learned Adding Value across Five Decades in the Difficult-to-Monetize Bioeconomy

Mark Jenner, Biomass Rules! https://biomassrules.com/

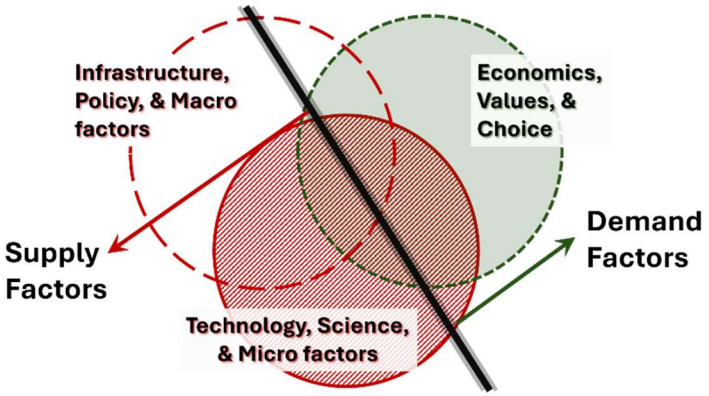
Recently, the bioenergy datacenter development project team I am on asked me to identify what is different about developing a biomass project in rural America. These are the key takeaways not commonly found in textbooks that occur in short-run supply, long-run supply, and from demand.

Short-run supply lessons

1. **Emissions are outputs.** Eggs and manure emerge from the same orifice on a chicken. Eggs have an established market value. Manure, especially unmanaged manure, has no price discovery market. Similarly natural gas is 96% methane, but when it is a fuel, we call it natural gas. When it is leakage, we call it methane. RNG is both a fuel and transformed methane leakage.
2. **Technology matters.** Technology determines whether organic byproducts are adding economic growth or costing the economy as an externality. When the target resource is a regulated waste, we use a ***treatment*** technology. Resource feedstocks, use a ***processing*** technology. Anaerobic digesters are the same technology regardless of the label for the influent. Poorly managed manure is a liability with a measurable cost of production. The same manure transformed into a product in demand, like RNG, becomes a revenue center.
3. **Byproduct supply is fixed on the level of production set by the principal commodity price driver.** Egg production does not increase when manure sales increase. Whey protein, today, is still produced at the market demand for cheese, even though the Wall Street Journal recently speculated the whey protein price increases may drive cheese production eventually. Corn and soybean planted acreage are both usually driven by demand for non-food components, even though the food component part is usually higher on a per pound basis.

Long-run supply lessons

1. **Economies of scope (multiple outputs per unit of capital) are often ignored.** Economies of scale are very popular (and likely more valuable). Scale is an economy of specialization. Multiple products from the same facility, or economies of scope, are economies of diversification. Conceptually, scope economies are more complicated. Economies of scope and scale are not mutually exclusive. Successful businesses maximize both scale and scope.
2. **Every US law that impacts plants and animals, both cultivated and indigenous, is a rule that influences carbon decisions.** The Clean Air Act, Clean Water Act, Resource Conservation Act (solid waste), all played a role in the development of current RNG (Renewable Natural Gas) markets. Even domestic and international tourists traveling to the US national parks (Yosemite) impact carbon emissions, not to mention the carbon sequestration of the sequoias. Carbon policies also include RFS, Low Carbon Fuel Standards, and Sustainable Aviation Fuel. One, quietly powerful carbon policy is the Federal BioPreferred Program. USDA sets biomass levels on products purchase by the government.
3. **Confusion becomes a barrier to forward progress when more than one definition of the same term is in play.** Working in manure policy the debates were always on manure, but too often it was defined differently by the stakeholders. Effective rules require all parties to use the same definition.
4. **Different kinds of laws create different standards.** The nutrient content for manure is based on an average value. State fertilizer laws regulate fertilizer sales based on a guaranteed minimum content of the nutrients. Important laws can create conflicts.



Demand and consumer choice lessons

1. **In biomass, local markets differ from global markets.** The economics are not the same. Feedlots, ethanol plants, food processing facilities, even digesters, command local economics. These businesses are often locally produced and locally consumed. Demand for local materials has a price premium, distribution costs are low to non-existent, the facilities may be vertically integrated. When local demand is not sufficient, output moves to more distant markets (global).
2. **These local bioeconomic industries create rural wealth**. They provide more local jobs and enhance communities in real, but difficult to monetize ways. Rural communities leverage community networks of social, political and cultural capital. High school football games, charity foundation owned thrift stores, and junior livestock sales shape leaders, convey shifts in businesses and opportunities, and generate funds that are invested locally. These difficult to monetize, in-kind types of capital lower fixed and variable costs. They provide a comparative advantage through both economies of scope and scale.

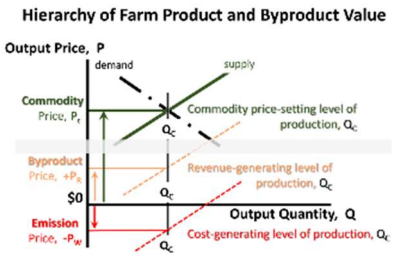
These are lessons learned developing organic byproduct policy, technology transfer, and education over fifty years.

Food Waste is Best Defined as a Feedstock – Food Price Fun, 7/3/26

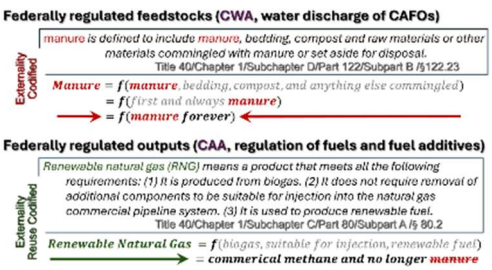
POP QUIZ: "Good ~~manure~~ food waste…

a. has ***more value*** than it costs to handle?" **[Value-Adding]**
b. costs ***about as much*** to handle as it is worth?" **[Break-Even]**
c. ***costs more to handle*** than it is worth?" **[Disposal Cost]**
d. ***doesn't exist***. There is no such thing as good food waste." **[Out to Lunch]**

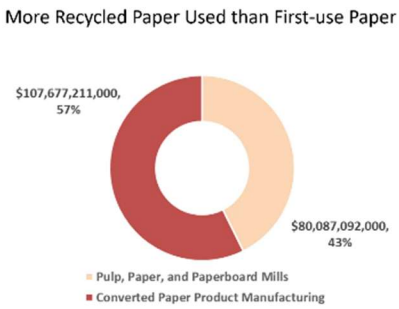
Byproduct Price Discovery in the Absence of Demand – Real Adventures in Economics, 1/20/25.



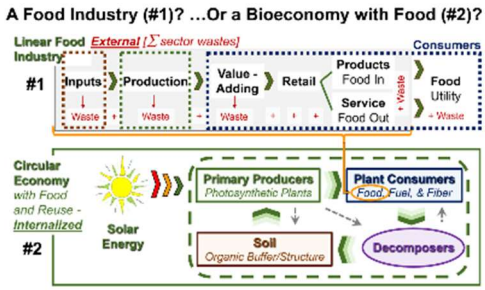
Regulating Carbon Emissions into Water and Air – Old School Style, 6/29/26.



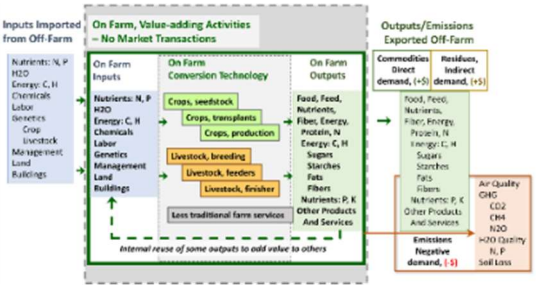
Being Green and Clean is More than a Dogma, 1/3/25



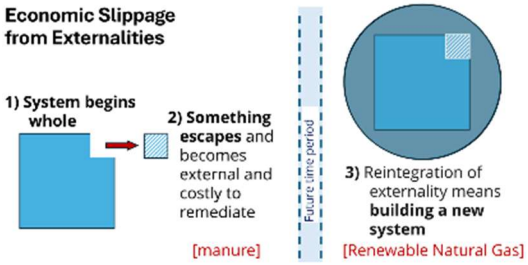
The World, the Economy, and Food Waste Management, are not Flat, 6/25/26.



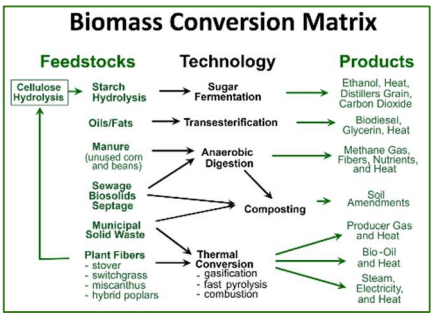
Byproduct Value in Closed and Open Production Systems, 7/3/24



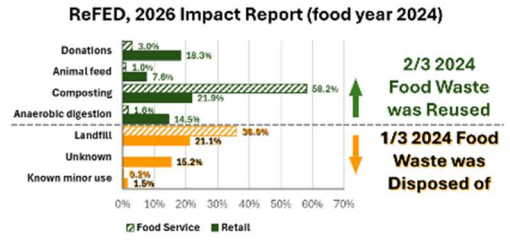
Solutions to Economic Externalities Require Both Problem Definition and Vision, 5/20/26.



Morphing Waste to Revenue – Breaking Free of Old Views, 7/1/24

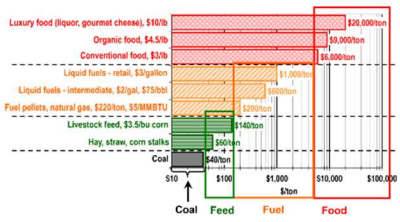


Unpacking the Latest ReFED Food Waste Impact Findings, 4/1/26.



Price of Carbon – Food vs. Fuel? The Price of Food Dominates Alternative Use Markets, 6/11/24

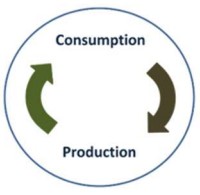
$ Food > $ Fuel > $ Feed



Anaerobic Digestion of Food Waste is Growing, 11/11/25.

A Tale of Two Markets: Local and Global, 3/26/24

Local – Produced and consumed in the same place



Global – Produced and consumed in different places