Sustainable Energy from Agriculture; Food and/or Fuel[i]

John Ikerd[ii]

Change, fundamental change, is no longer an option in America; it is an absolute necessity. We are confronted with a storm of ecological, social, and economic crises that threaten the future of the nation and perhaps of humanity. None in more critical that the pending depletion of fossil energy. Unfortunately, most people don't make fundamental changes in their lives until three conditions are present. First, they must conclude that what they are doing now is not working for them and will not likely work in the future. Second, they must have a clear concept or vision of what they could differently that would make their lives better. Finally, they must believe that is possible to make the transition from what they are doing now to what they would rather do instead. Major changes in life are always risky and sometimes difficult and painful. Lacking any one of the three conditions, most people will just keep on doing what they have been doing, which America can no longer afford.

The question of sustainability is basically a question of whether we can keep doing what we have been doing. Is what we are doing sustainable? It's a question of whether we can meet the needs of the present without diminishing opportunities for the future. For those who are willing to ask question of sustainability, it's becoming increasingly obvious that our current economy and society are most certainly diminishing opportunities for those of the future. At the most basic level, today's children are the first generation expected to have shorter life spans than their parents. Our economy is being propped up government spending that is running up huge debts that one way or another will be paid by some future generation. The twin ecological threats of fossil energy depletion and global climate change threaten the very future of human life on earth.

For an increasing number of people our current economy and society are not even meeting their basic needs of the present, let alone the future. The current economic recession, although officially over, is slowly drifting into a "Great Retrenchment," if we are lucky enough to avoid another "Great Depression." A "jobless recovery" means that the wealthy continue to get richer while too many of the rest of us remain unemployed or underemployed. A host of publicly available statistics confirms that we live in an increasingly inequitable, unhealthy, dissatisfied, antagonistic, unhappy society. It should be obvious to anyone willing to take the question of sustainability seriously; we simply cannot continue doing what we have been doing. Our current way of life is not sustainable.

All questions of sustainability are ultimately questions of energy. Everything that is of use to us – our cars, houses, clothes, food – requires energy to make, energy to use; in fact, all

---

[i] Prepared for presentation at The Annual Harvest Festival and Energy Fair, Duluth, MN, September 11, 2010 and ONE (Ozark New Energy) Conference, Springfield, MO, October 7, 2010.

[ii] John Ikerd is Professor Emeritus, University of Missouri, Columbia, MO – USA; Author of, *Sustainable Capitalism*, http://www.kpbooks.com , *A Return to Common Sense*, http://www.rtedwards.com/books/171/, *Small Farms are Real Farms*, Acres USA , http://www.acresusa.com/other/contact.htm, *Crisis and Opportunity: Sustainability in American Agriculture*, University of Nebraska Press http://nebraskapress.unl.edu; and A *Revolution of the Middle and the Pursuit of Happiness*, on line at http://sites.google.com/site/revolutionofthemiddle/ . Email: JEIkerd@centurytel.net; Website: http://faculty.missouri.edu/ikerdj/ or http://www.johnikerd.com .

material things are simply concentrated forms of energy. All useful human activities – working, managing, thinking – also require energy. Humans are capable of being "useful" only after they have been nurtured, socialized, and educated, all of which require energy.

According to the laws of thermodynamics, energy can neither be created nor destroyed. However, each time energy is used to do anything useful, some of its usefulness is lost. Whenever energy is used to do anything useful, which physicists call *work*, it inevitably changes in form. Specifically, it changes from more-concentrated, more-organized forms to less-concentrated, less-organized forms, as when gasoline explodes in the engine of a car. The energy hasn't been destroyed but it has been disturbed and dispersed. It is then less concentrated, less organized, and thus less useful. Each time energy is uses and reused, it becomes less useful. This is the essence of the physical law of entropy. Waste is simply energy that we don't know how to use. Pollution is negative energy in that it requires energy to mitigate its negative impacts or degrades the ability of nature to sequester solar energy. Reducing, reusing, and recycling can improve the efficiency of energy use, allowing us to get more usefulness from a given amount of energy, but nothing can prevent the inevitable loss of energy to entropy.

The concept of entropy was of little practical or public interest as long as the world had plenty of cheap energy and plenty of places to dump our wastes and pollutants. In fact, the industrial era of economic development of the past two-hundred years was fueled by abundant cheap energy; first old growth forests, then coal, and for the past century, mostly petroleum. However, the old growth forests have been cut down, the surface veins of coal mined out, and the shallow oil fields pumped dry. In addition, there is nowhere left to dump industrial wastes and pollutants without incurring large ecological, social, and economic costs.

We simply can no longer rely on fossil energy to sustain our economy and society. There is general agreement among petroleum geologists that we are either at or near a peak in global petroleum production. We have used about half of total global oil reserves in a little more than one hundred years. We are not out of oil, at least not yet, but the remaining reserves will be more difficult and costly to extract and to use. Incidents such as the BP oil spill in the Gulf of Mexico may be much more common as we scour the remote corners of the earth for the remaining oil. Even so, oil production will inevitably decline year after year. Peaks and declines in all other sources of fossil energy are expected during the first half of this century. In addition, we can't use the remaining stocks of alternative fossil energy, particularly coal, without increasing the threats of global climate change. The only sustainable source of energy available to offset the inevitable entropy of fossil energy is solar energy – the only source of truly renewable energy.

The most promising means of sequestering solar energy appear to be windmills, falling water, direct thermal heating, photovoltaics, and biofuels. All of these hold promise as sustainable sources of energy for the future, but all together will be less plentiful and more costly than the fossil energy sources they replace. The earth's supply of fossil stocks were sequestered by green plants and algae over millions of years and we will have depleted the recoverable reserves in less than three centuries. Once it takes more energy to extract and refine energy than the energy made available for use, extraction will stop. In the future we will be forced to rely on the daily flow of solar energy rather than the abundant stocks of the past. The industrial era of the past two hundred years was fueled by cheap fossil energy. The industrial era is over.

It's only logical that we look to agriculture as a source of renewable energy. Agriculture has greatly enhanced the extraction of food energy from nature. Many seem to believe that it has the same potential to enhance the extraction of energy for fuel. However, if agriculture is to be a *sustainable* source of energy for food or fuel, we must first create a sustainable agriculture.

A sustainable agriculture, like all other sustainable development, must meet the needs of the present without diminishing opportunities for the future. It must be ecologically sound, because all agricultural productivity originates in the land – in the resources of nature. It must be socially responsible, because the fundamental purpose of agriculture is to meet the needs of people – not just consumers but also farmers and society in general. It must also be economically viable for farmers. A sustainable agriculture also must be economically viable for farmers. All economic value originates in nature and society. The economy produces nothing; it simply facilitates our relationships with nature and society. So, an economically viable agriculture must be ecologically sound and socially responsible. Lacking any one of the three, it is not sustainable.

Our current industrial agricultural system is very efficient in extracting energy from both land and people, but it is not sustainable. It is depleting the health and natural productivity of the soil by relying on fossil energy based fertilizers instead of new solar energy. It is degrading the productivity of farmers by replacing innovation and creativity with industrial technologies. It is polluting our air and water with chemical and biological wastes. Not even the oceans are spared, with growing dead zones in the Gulf of Mexico, Chesapeake Bay, and elsewhere. These concerns might be mitigated if today's agriculture were actually meeting the food and fiber needs of society. However, the industrialization of agriculture has not diminished hunger in America and in fact is threatening the health and well-being of American consumers by producing food of questionable safety and nutrient value. It is not sustainable.

Today's questions of sustainability, including those in agriculture, arise from the pursuit of individual, economic self-interests. Economic value is inherently individualistic. The aggregate economy is nothing more than a collection of individuals. There is no economic value in doing anything for the sole benefit of someone else or for society in general. All economic acts of social and ecological responsibility are premised on the expectation of getting something of individual value in return. Since economic value accrues to the individual, it must be expected to accrue during an individual's lifetime. There is no way to realize economic value after death. Since life is inherently uncertain, the economy places a premium on the present relative to the future. This is not a philosophical proposition. The diminishing economic value of benefits and costs over time is clearly reflected in market rates of interest. At a seven percent interest rate, a dollar ten years in the future is only worth fifty-cents today, because fifty-cents invested today at seven percent interest will be worth a dollar in ten years.

Economic value reflects the usefulness of goods or services that is derived from the usefulness of energy which must come from nature and society. Once the usefulness of nature and society has been depleted, there will be no remaining source of economic value. While there is economic value in extracting energy to meet the current needs and wants of individuals, there is no economic incentive to restore energy to either nature or society for the benefit of society as a whole or for future generations. When the useful energy in nature and society has been depleted, there will be no source of economic value to meet even our individual wants or needs. Based on everything we know about natural ecosystems and human societies, today's economy places far too little value on the future to ensure ecological, social, or economic sustainability.

Sustainability will require a fundamentally different way of thinking about how the world works and our place within it. As Albert Einstein once observed, “We can't solve problems using the same thinking we used when we created them.” Increasing the efficiency of energy use, while necessary, will not be sufficient to achieve sustainability. No matter how efficiently we use fossil energy or how much we reduce wastes and pollution, we eventually will deplete the usefulness of energy. We can slow, but not stop, the tendency toward entropy. Substituting one fossil energy source for another, while necessary, will not be sufficient to achieve sustainability. Eventually, all sources of non-renewable energy, including nuclear energy, will be depleted. Ironically, even substitution of solar energy for fossil energy, again while necessary, will not be sufficient to achieve sustainability. We eventually will use up the means of sequestering solar energy, including the integrity of natural ecosystems. We must fundamentally change our way of thinking about our relationships with the things of nature and with other people.

Today's industrial model of economic development reflects a mechanistic view of a world that humans can manage and manipulate to meet their needs and wants. The adoption and use of the industrial paradigm is motivated by the pursuit of individual economic self-interests. A sustainable model of development must reflect an organismic view of a world that is a complex living organism of which we humans are an integral part. In this living world, relationships among people and between people and their natural environment matter. The whole is more than the sum of the parts. While we humans may be able to tip the ecological balance in our favor relative to other species, we cannot change the fundamental principles by which the world functions. We can ignore the laws of nature, including human nature, but we cannot avoid the consequences of violating them. To live sustainably, we must live in harmony with the living world around us.

Only living systems are capable of sequestering the solar energy necessary to offset the inevitable loss of usefulness of energy to entropy. Green leaves and algae are biological solar energy collectors. We humans can sequester solar energy by using windmills, falling water, and solar panels. However, we are biological beings and thus are inherently dependent on the solar energy captured by the green plants that we use for food and to feed our food animals. Living things also have a natural tendency to reproduce and regenerate their species, even when there are no economic incentives to do so. That's why plants devote a significant portion of their life's energy to producing seeds. That's why animals, including humans, devote so much energy to raising their offspring. The regeneration and renewal of living systems are the only concepts of sustainability we know, as all energy ultimately tends toward entropy.

Our current agricultural, economic, and social systems must be radically redesigned to mimic self-renewing, regenerative, living systems. It's absolutely necessary that we remain ever vigilant of the individual ecological, social, and economic impacts of our agricultural practices, regardless of whether we are producing food or fuel – necessary but not sufficient. Sufficiency requires that we be ever mindful of the living system as a whole, that “everything on earth is interconnected with everything else” – the first principle of ecology. If we understand our interconnectedness with the living world around us, we will automatically be vigilant of the impacts of our actions on the living system of which we are a part.

As the noted naturalist John Muir put it, “Everything eats, everything excretes; everything is food for something.” We humans are no exception. We are not nearly as dependent on our cars, houses, clothes, or adult toys as we are on the things we eat. Sure, we need clothing, shelter, some means of mobility, and even some recreation, but humans can do very well with relatively few of life's necessities. We are most critically dependent on the things we breathe, drink, and eat. The energy we use to fuel our cars and heat our homes comes from the same flow of energy that fuels the living things that fuel our bodies. Everything we do affects everything else.

The complex ecological system through which all bioenergy flows may be represented as a pyramid made up of various layers. The bottom layer is the soil, the next layer is plants, the next is all those things that feed on plants, including insect and animal *herbivores*, next is the things that feed on both plants and animals, the *omnivores*, mainly humans, and at the top, the things that eat only animals, the meat-eating *carnivores*. A generalization exists in ecology that on average, about 10% of the energy available in one layer will be passed on to the next level. “Not everything in the lower levels gets eaten, not everything that is eaten is digested, and energy is always being lost as heat”[1] – to entropy. So at each higher level of the pyramid, only about 10% as much energy is available as at the level immediately below it – energy becomes scarcer.

All *new* energy enters the biological pyramid at the level of plants, the solar collectors, and ultimately escapes into space as heat, the product of entropy. However, the inorganic nutrients – nitrogen, phosphorus, potassium, calcium – that plants must combine with carbon, oxygen, and hydrogen in storing energy – as carbohydrates or sugars – are continuously recycled through the soil's biological system. Many of these inorganic nutrients become available to the roots of plants only through the symbiotic actions of the *decomposers* in the soil, at the base of the pyramid. The billions and trillions of microorganisms in the soil extract their life's energy from the wastes discarded at all levels in the pyramid. The foods that support earthworms, bacteria, fungi, nematodes, and other decomposers in the soil is the energy left in the things that we humans call wastes, the energy that we now propose to extract from biomass for fuel.

When we generate energy from biomass, including crop residues, forage crops, animal manure, and other agricultural wastes, we are depriving the decomposers in agricultural soils of potential food they may need to make food available to the plants which fuel the entire pyramid. We humans live by eating other biological organisms. We can't eat the sun or digest the electricity generated by windmills, falling water, or photovoltaic cells. The decomposers need about 25% of all solar energy collected by the green plants. If we replaced even 10% of our current fossil fuels with biofuels, we could potentially deprive the decomposers of approximately 75% of waste energy currently available to produce food for plants.

The first priority for agriculture must be to provide a sustainable source of food energy for people. David Pimentel of Cornell University and others have estimated that if all of the solar energy collected by all of the green plants in the United States could be magically converted into fossil energy, without using fossil energy, it would replace only about *one-half* of the fossil energy consumed each year in the United States.[2] Some bioenergy advocates have attempted to discredit Pimentel's work, but he has been focusing his research efforts on bioenergy since the 1970s and is highly respected among those who have followed his work over the years. He also estimates that agriculture and forestry account for less than one-third of all green plants, and thus, solar energy captured by the whole of farms and commercial forests amounts to less than *one-sixth* of annual U.S. fossil energy use.[3] These estimates are confirmed by a panel of energy experts in a 2006 Academy of Science report dealing with the energy potential of agriculture.[4] We can't devote the whole of agriculture to biofuels, particularly not an agriculture that depends on fossil energy. Future generations will need that biological energy to fuel their bodies.

That being said, agriculture quite possibly could provide a significant sustainable source of fuel as well as food. However, for agriculture to become a sustainable source of bioenergy, it must function within the context of a sustainable society and economy redesigned according to the paradigm of living systems. Living systems are inherently diverse, dispersed, and interdependent, not specialized, standardized, and centrally controlled. A sustainable agriculture must function within the context of diverse, dispersed, interdependent local economies and communities.

Sustainable communities need not be economically self-sufficient, but locally owned and operated businesses must be capable of meeting most basic day-to-day needs of the community. Local businesses will need to be sustained by the commitment of the community to support its local economy. Local builders will need to provide affordable, energy-efficient housing. Energy-generating residences and locally-owned electric utilities will need to meet most of their energy needs of the community with wind, water, and solar generated electricity. Communities in agricultural areas will have opportunities to produce local energy from energy crops and crop residues. However, the highest priority for agriculture must be to provide local food security – not self-sufficiency but food sovereignty. The first priority for sustainable farmers will be to provide local residents with foods that have ecological, social, and economic integrity.

With respect to sustainable energy from sustainable agriculture, pyrolysis and gasification seem to be among the most promising technologies on the horizon. Pyrolysis refers to chemical decomposition of organic materials under high temperatures and in the absence of oxygen. Gasification is a similar process with limited oxygen. The process has been used extensively in industry for a variety of purposes, including production of charcoal. The resulting biological materials include various types of fuel, biochar, and tars. Bio-gasses created by combustion can be converted into ethanol and biodiesel as well as burned directly.

Pyrolysis and gasification have several significant ecological advantages over current methods of producing ethanol and biodiesel from corn and soybeans. Pyrolysis does not require large amounts of water and does not pollute the air with carbon dioxide. Perhaps most important, carbon for the biomass is sequestered in biochar that can be incorporated back into croplands to increase soil fertility by promoting synergistic relationships between the soil, soil organisms, roots of the plants, water, and carbon-dioxide and nitrogen in the atmosphere. Crops grown for pyrolysis and gasification also tend to be perennial crops that require no tillage after establishment and require less fertilizer, pesticides, and fuel. Such bioenergy systems may actually sequester more greenhouse gasses than are released.

Pyrolysis and gasification also seem to have particular advantages for sustaining rural communities and local economies. The basic technology is adaptable to a wide variety of sizes, making *decentralized* systems of renewable energy production more feasible and cost competitive. Smaller systems allow individual farmers, or small groups of farmers, to produce fuel for their farm and home energy needs, without depleting the natural productivity of their soil. Community-based operations allow recycling of bioenergy and biochar within local communities –reducing energy costs for local residents by reducing energy losses in transmission and transportation. Biochar could also be applied to home gardens and vacant urban and suburban plots to increase the availability of fertile land for local food and energy production

A variety of other scale-appropriate technologies can be utilized to produce community-based energy from biological wastes while reducing environmental pollution. However, we must remain ever mindful that energy efficiency and substitution, while necessary, are not sufficient to ensure sustainable energy. We must choose feedstocks for bioenergy that do not deprive the decomposers in the soil of the energy they need to help feed the plants that produce food for humans. Sustainable local energy systems must be designed to enhance the ecological, social, and economic integrity of the community. The paradigm or model for sustainable local energy can be found in the emerging paradigm for sustainable local food systems.

Many people see the local food movement as something new, but it is simply a continuation of the natural food movement that began back in the 1960s. Rachel Carson's classic book, *Silent Spring*, triggered a rebellion against industrial agriculture and its dependency on pesticides and other agrochemicals. The people of the “back to the earth” movement proclaimed their methods of farming and food production as “natural,” meaning the produced in harmony with nature. As the natural food movement grew in popularity during the 1970s and 1980s, relationships between producers and consumers became less personal. This lack of personal knowledge created a need to be more specific in distinguishing “natural” from “conventionally” produced foods.

Organic foods emerged to meet the need to define the meaning of natural foods. The historical mission of organic farming was to create a “permanent” agriculture – a sustainable agriculture. During the early days of organics, a number of organic certifying organizations sprang up all across the country. During the 1990s, consumer demand for organic foods boomed, doubling every three to four years. The mainstream supermarkets needed a uniform standard to accommodate their mass distribution system. Organic farmers were convinced a uniform standard would give them greater market access and supported national organic standards.

It did; but as the organic market continued to grow, standardization allowed organic production to be routinized and simplified, which allowed consolidation of control among fewer, larger producers and retailers. This industrialization of organics allowed producers who could meet the minimum standards at the lowest cost to gain control of the organic markets. The focus has been shifted from “permanence” – which requires ecological, social, and economic integrity – to economic efficiency and corporate profitability.

The local food movement emerged in response to growing concern for the lack of integrity of industrial organics. Many people don't trust the giant food corporations or the government to ensure the integrity of their foods – even organic foods. They want to buy from local farmers –

people they know and trust, or at least can get to know and trust. The numbers of farmers markets and community supported agriculture organizations (CSAs) have doubled each of the past two decades, during the period of industrialization of organics.

America is building up to a food revolution. Best-selling books, such as *Fast Food Nation*[5] and *Omnivore's Dilemma,*[6] awakened mainstream society to the dramatic changes that have been taking place in our food system. Video documentaries such as *Future of Food,*[7] *Broken Limbs,*[8] *Food Inc*[9] and *Fresh; the Movie*[10] provide gripping images of the negative ecological and social impacts of an industrial food system on nature, society, and on the future of humanity. The HBO network has a new multi-documentary project in development linking the rise in obesity and other diet related health problems to the industrialization of agriculture. They all tell the same story of a food system that is lacking in ecological, social, and economic integrity.

Thankfully, the various books and documentaries also tell a story of hope for the future through the voices and images of the farmers and consumers who are creating a new, sustainable food system. The farmers may label themselves organic, biodynamic, ecological, natural, holistic, or choose no label at all; but they were all pursuing the same basic purpose. They are creating a permanent, sustainable agriculture. They are producing food with ecological, social, and economic integrity.

The stories tend to focus on a few ce*lebrity farmers*, such as *Joel Salatin*[11] (*Polyface Farms, Inc.*) of Swope, VA and *Will Allen*[12] (*Growing Power Inc.*) of Milwaukee, WI. However, there are tens of thousands of these new farmers scattered across the country. At least six "sustainable agriculture" conferences in the U.S. and Canada draw 1,500 to 2,500 people each year – including both farmers and their customers. Conferences drawing 500 to 700 people are commonplace and virtually every state in the U.S. has an organic or sustainable agriculture organization, drawing 100 to 250 people to their annual conferences. The modern sustainable agriculture movement, which began with the "back to the earth" movement of the 1960s, is spreading like wildfire through American agriculture into the American food economy.

People tend to underestimate the importance of the local food movement because they associate it with farmers markets and community supported agricultural organizations or CSAs – and more recently with home and community gardens. While these are and will continue to be important, the local food movement is probably most accurately defined by the growing number of retail food stores, restaurants, and institutional food buyers who are committed to sourcing as much food as possible from local growers. The total sales of all alternative foods – natural, organic, local…, – probably still amount to something less than 10% of total retail food sales. However, natural/organic/local foods have been the fastest growing segment of the food system over the past two decades, roughly doubling in size every three to four years. It will only take the right spark at the right time to ignite a food revolution.

America is poised for fundamental changes in the ways we produce both our food and our fuel. There is a growing awareness that things we have been doing aren't working anymore and aren't going to work in the future. A growing number of people also are beginning to develop a clear concept, a new vision, of a new and better world that we can create for the future – a world in which we can meet the needs of the present without diminishing opportunities for the future. We see that vision perhaps most clearly in emergence of new sustainable, local food systems.

We are beginning to envision of a new kind of agriculture that enhances the biological and mental health of individuals; promotes the economic and social health of families, communities, and societies; sustains the ecological health and productivity of natural ecosystems; and fulfills the ethical and moral responsibilities of each generation for the future of humanity. We can see the possibility of a sustainable agriculture that produces both food and fuel to meet our needs without diminishing opportunities for those of the future. In a sustainable agriculture, we also see the possibility a new and fundamentally better economy and society that provide permanent sustenance for the material, social, and spiritual well-being of all people. This vision of the future is worthy of taking the risks and enduring the inevitable stress and hardships of change.

We know that such a future is possible, even if not quick and easy to achieve. In this possibility there is hope – the final requisite for change. We see reason for hope in the everyday reality of those who are creating and supporting sustainable, local food systems. We see hope in the emerging sources of renewable, local energy. We see hope in the new eco-municipalities that are creating sustainable local economies and communities. We also see hope in a growing realization that economics is not all that counts – that relationships and ethics also matter.

We know we are social beings and we need relationships with others, not just to meet our individual needs but to meet our needs for friends, family, and community – to love and be loved. We know we are also moral beings; we need a sense of rightness and goodness in our relationships with each other and with the earth – to give our lives purpose and meaning. We know in our hearts that it is not a sacrifice to care for each other and take care of the earth, as we take care of ourselves; relationships and stewardship give our lives quality and meaning. We know it is possible to create a new and better world. In this possibility, in this hopefulness, is the final requisite we need to bring about the fundamental change we need, the change we must make, not only for ourselves but for the future of humanity.

End notes:

[1] Dave McShaffrey, "Environmental Biology- Ecosystems," Department of Biology and Environmental Science, Marietta College http://www.marietta.edu/~biol/102/ecosystem.html.

[2] From a presentation by David Pimentel, Cornell University, at *Local Solutions to Energy Dilemma*, New York City, April 28-29, 2006. Revised to account for increased energy use from earlier estimate published in David and Marcia Pimentel, *Food, Energy, and Society* (Niwot, CO: University Press of Colorado), 1996.

[3] David and Marcia Pimentel, *Food, Energy, and Society* (Niwot, CO: University Press of Colorado), 1996, 20.

[4] Jason Hill, Erik Nelson, David Tilman, Stephen Polask, and Douglas Tiffany, 2006, "Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels," National Academy of Science Report, http://www.pnas.org/cgi/content/short/103/30/11206.

[5] Eric Schlosser, *Fast Food Nation: The Dark Side of the All-American Meal* (New York: Houghton Mifflin, 2001).

[6] Michael Pollan, *The Omnivore's Dilemma: A Natural History of Four Meals* (New York: Penguin Press, 2006).

[7] *The Future of Food* <http://www.thefutureoffood.com/>

[8] *Broken Limbs*, <http://www.brokenlimbs.org/endorsements.html>

[9] *Food Inc.*, <http://www.foodincmovie.com/>

[10] *Fresh; the Movie* <http://www.freshthemovie.com/>

[11] *Polyface Farms Inc*. <http://www.polyfacefarms.com/>

[12] *Growing Power*, <http://www.growingpower.org/>