Other Inconvenient Truths: The Agriculture, Water and Energy Nexus

Global warming gets a lot of attention but there are things beneath it that are actually more urgent. If we address those we can address global warming. In many ways the agriculture/water/energy problem is an economic one which, if we can solve it, will lead to reductions in global warming. Three billion people in the world will be entering the middle class in the next 50 to 60 years. These will come predominantly from China and India. This will put tremendous strain on resources, not least of which is food production. Since resources are interlinked, the pressure exerted by this rising population, which will consume a great deal more in way of resources, will have a multiplicative effect on competition for resources. This will make it all the more urgent that we develop new and sustainable tools and new solutions for resource management.

Already in some parts of the world, people are finding they must choose between having energy or food or water. In Texas, for instance, where there has been a boom in hydraulic fracturing (fracking) in oil and gas exploration, choices are being made between fracking and farming since both require a lot of water and there isn't enough available for both. Energy companies there are offering farmers huge sums of money for their water.

Concern over global warming has focused heavily on carbon dioxide in the atmosphere. While that is important, it is also important to recognize a super-nexus of concern that is emerging: that of agriculture, water and energy. The reason this is emerging as a source of urgent concern is the depletion of resources that is occurring as economic development raises the expectations of the fast-growing middle class around the globe.

Throughout our history, we have had a culture of exploration and extraction when it comes to finding new resources. In essence, it was to find another deposit of whatever resource we needed, be it a coal mine, oil field or aquifer. That works up to a point, but ultimately we will be faced with the need to recycle resources in order to have a sustainable supply to support our civilization. Recycling resources will also lead to environmental and even economic sustainability. This view of the future does not come from "doomsday preppers" or political radicals. Rather, it comes from the McKinsey Group, one of the largest consulting companies in the world.

As the new middle class emerges, according to McKinsey, we will see intense price competition for resources. That is why the effect of this population on the rising cost of resources will be multiplicative rather than linear. In other words, the curve will not rise gradually but instead rather steeply.

Of course, all energy comes from the sun, whether it is in coal, oil or gas deposits that hold the sun's energy from millions of years ago or today when the sun provides energy for our crops. That means the amount of energy on our planet is finite. That is why companies have to invest more to extract new sources of oil and that includes the amount of energy they use to find it. These days they are using a ratio called energy return on investment (EROI) to grade how much it requires to access fossil fuel deposits. When it comes to resources such as tar sands in Canada, those EROI's are worse than or similar to what we see for renewable energy sources

such as wind and solar. In general, EROI's for fossil fuels and renewable sources are beginning to intersect. In 1971, Dr. Earl Cook at Texas A&M University plotted energy consumption per capita per day for various levels of societal sophistication. He began with the primitive societies and ended with the technological societies such as ours. According to his calculations, technological societies of today consume 12,000 times more energy per capita than the early primitive societies. Cook's work is confirmed by work done at the U.S. Department of Energy.

The picture for water is similarly challenging. Experts predict a 40 percent "water gap" by 2030. Within societies we are seeing conflicting demands for water. In many instances, the competition is between agriculture and energy uses. In one way, the water situation is more critical than energy because the earth has a finite amount of water whereas the sun keeps sending energy our way. Even if we build desalinization plants and make fresh water from the sea, it will have an impact on the environment. For instance, the Colorado River delta long ago dried up because of the huge amount of water taken from it to support Southern California's water needs. Consequently, when it comes to water, developments are pointing to some type of recycling effort on a large scale. Recycling water can be done by physical engineering methods and microbiological methods. As time goes on, I believe we will use more microbiological approaches because microorganisms have a tremendous capacity to take harmful materials out of water.

In addition to the water and energy nexus in regard to agriculture, we have a looming fertilizer crisis. The phosphorus mines are starting to run out. Some argue that phosphate will run out in 50 years and others say it will do so in 150 years. I maintain it doesn't matter which is correct because demand for this finite resource will make it so expensive other answers to the problem will have to be found. We are already seeing answers where scarcities exist. In Texas, where water is scarce, they now get 15 percent of their energy from wind. Why? It is because water is scarce there and it takes a lot of water to make energy. They have lots of wind in Texas. The same trade-offs exist with food. It takes a lot of water to make beef when one considers everything that goes into it. On the other hand, it takes far less water to make sugar.

Here is a case study: Our company did a project at Bindaree beef, a livestock processor in Australia. What Bindaree Beef wanted to know was could we take their beef waste and economically produce energy, water and recoverable fertilizer? Their goal was to get off the grid because the only way they could expand their operation was to produce their own energy. It would have cost upwards of $100 million to bring in a new electric transmission line from Brisbane. This is a case where achieving future sustainability for their business would also create sustainability for the environment.

We used a highly reliable biological conversion technology to meet their goals. The system produces fertilizer, electricity and what they call Class A water. Another result is that this creates a couple of hundred new jobs through expansion of their business and operating the system. It also eliminates their need for a landfill and their use of coal. The plant they constructed is a large anaerobic digester that achieves over 90 percent conversion of organic matter into energy, water and recoverable fertilizer. Bindaree Beef will not use the fertilizer but will sell it to add to their revenue stream. One of the advantages of recovered fertilizer from processes like this is it is high in phosphorus — a nutrient the mining of which has a finite future.

Moving toward more renewable resource technologies such as this is the wave of the future as the agriculture/water/energy nexus comes under severe pressure and more of the population around the world moves up the socio-economic ladder and demands more in way of resources.