

Abstract for Bruce Dale Keynote Speech

“Bioenergy and Biofuels: Getting to Very Large Scale- Sustainably”

Industrial society is characterized by enormous physical waste—literal mountains of garbage, and also by large scale waste of resources including soil, water, air and minerals. Current industrial society depends on fossil energy resources, which were once abundant but are now depleting quickly. High rates of energy consumption generate much wealth. Indeed, the per capita rate of energy use (power per capita) is linearly proportional to the per capita gross domestic product. However, this wealth is very unequally distributed.

While human well-being is also a strong positive function of power consumption at low power use, well-being does not increase much when per capita power exceeds about 4 kilowatts per person. With 8 billion people expected soon on the planet, that means 32 terawatts of total power is required to provide everyone about 4 kilowatts. Current world power consumption is approximately 17 terawatt...85% from fossil energy (petroleum, natural gas, and oil). It is irresponsible to act as if we should or even can rely on fossil fuels to underpin human wealth and well-being in the future.

So, where will this much power come from, now and in the future? Clearly we must think big. We need potentially big solutions to the big problem of providing energy to the world. We need to drastically increase energy efficiency, avoid waste of all kinds, and use wastes whenever possible for their value as energy or their embedded energy as materials.

This presentation describes the use of “waste” agricultural resources to provide low-carbon fuels for global society. These “wastes” include actual physical wastes such as manures and inedible (by humans) crop residues. Unused photosynthetic potential is also a waste. Thus the presentation describes how agriculture can improve its economic and environmental footprint by using double crops to increase sustainable biomass output per hectare. These double crops can be processed liquid fuels (via cellulosic biofuel systems) and gaseous fuels (via anaerobic digestion) and help meet humankind’s energy needs more sustainably. Since agricultural resources are much more evenly distributed than are fossil energy resources, the potential exists to reduce global income inequality by using renewable fuels to generate more broadly-based wealth.