

“Bringing it all back home” How waste-to-biobased products is good for energy, the environment, water, and society

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Around the world societies want better access to affordable energy and water while protecting the environment. Health and happiness are dependent on finding the answer. Biomass and waste materials offer the opportunity to provide value-added materials and energy and clean the environment without competing for food. Using renewable resources such as biomass and waste materials requires deeper insight than using fossil resources such as coal, oil, and natural gas. Renewable resources primarily use solar and have the potential to reduce greenhouse gas emissions. Renewable resources are more distributed and less dense than fossil resources so biorefineries must be designed at smaller scales than oil refineries. About half of the weight of renewable resources is oxygen. To manage the oxygen content requires either addition of hydrogen or loss of carbon as carbon dioxide. Adding hydrogen requires energy and losing carbon decreases yield so compromises must be made. Fossil resources have very little oxygen.

“Bringing it all back home” is a way to build a strong economy while protecting the environment. You avoid depletion of resources by starting with renewable resources and then reusing them. This includes energy, water, and materials. This approach to sustainability could benefit the U.S., Thailand, and many other countries. When fully implemented it could reduce conflict for resources.

We will discuss the types of energy needed for society, how renewable resources could provide that energy, new technologies for converting feedstocks and recovering the purified products, the costs for producing energy and materials from renewable resources, and policy and regulations that impact production. Separations and product recovery can account for more than half of the costs for using renewable resources. We will discuss state-of-the-art technologies the use electricity to recover valuable renewable products. We will discuss advanced methods to enhance anaerobic digestion to convert waste materials to renewable natural gas. We will discuss effectively utilize nutrients to protect cropland and produce bioenergy. Finally we will describe how these new technologies improve water quality to ensure a safe water supply and a clean environment.

Together the work will show a path to a healthy life using renewable materials and energy.