Summary of the November 2009 Forum
Center for BioEnergy Sustainability (CEBS)
"Value-Chain Analysis and Its Application in Bioenergy Path Analysis"

Virginia Dale introduced the panel of speakers: Rekha Pillai, Sirisha Nukala, Stuart Daw, and Charles Finney, all from Oak Ridge National Laboratory (ORNL).

Value chain is a business-management concept popularized by Michael Porter in 1985. It is a high-level model of how businesses receive materials as inputs, add value to the materials through various processes, and sell finished products to the customers. Value-chain analysis categorizes and examines the value-adding activities in an organization. However, it is different from simply accumulating the costs that accrue during the activities. Indeed, the value added (or lost) can be quite different from the costs involved. For example, the cutting of a diamond has a relatively low cost, especially in comparison to the cost of extracting the diamond from the Earth. However, cutting the diamond well adds significant value to the end product; rough diamonds cost quite a bit less than cut diamonds.

Supply chain analysis is a very well known concept and is often confused with value chain. There is subtle difference between supply chain and value chain even though both the concepts share the same network of companies and both are made up of companies that interact to provide goods and services. The supply chain focuses on upstream integration of supplier and producer processes, improving efficiency and reducing waste. Creating a successful supply chain involves reducing costs and attaining operational excellence. The value chain, on the other hand, focuses on downstream activities to create value in the eyes of the customer. Creating a profitable value chain, therefore, requires alignment between what the customer wants (the demand chain) and what is produced via the supply chain.

Value-chain analysis is employed in order to cut costs (by increasing yield, improving efficiency, and eliminating waste), increase flexibility (by conducting R&D, making multiple use of the product or service, adding functionality, and reducing product-development time), and create metrics to measure performance (decreasing the lead time, increasing the variety of products, lowering the unit cost, lowering inventory, and increasing quality). Value-chain analysis looks at whether one can (1) reduce costs while holding value constant, (2) increase value while holding costs constant, or (3) reduce assets (resources) while holding costs and value (revenue, service, credibility, etc.) constant.

Value-chain analysis determines which type of competitive advantage to pursue and how to pursue it: through science and technology investment, capital investment, marketing, policy, standards and incentives, and/or education and outreach. These are competing investments in a nexus in which innovation becomes a key element of development. Trends that drive the need for operations-oriented analysis from a value-chain perspective include increasing competition, increasing the focus on innovation, the fact that many benefits have already been wrung out of manufacturing and the supply chain, the globalization of supply and production, and an evolution of governance models for the extended enterprise. Knowing the value offered to a community allows one to operate a sustainable enterprise.

Value chain is not policy-neutral. Government policy, environmental regulations, and taxes affect the dimensions, shape, and form of the industry value chain. Values change because of competitive pressures and are increasingly global in nature. Externalities affect costs and values. Waste management, for example, may vary to exploit increases in the value of the waste available or changes in the costs of disposal. Levels of profitability at the different stages of the chain will affect the attractiveness of different levels of reuse. Recycling will be influenced by material-ownership structures within the chain.

Value-chain analysis helps in the evaluation of sustainable-development strategies. It allows one to include social, environmental, etc. values into the analysis of an energy-production or energy-use process. Biosustainable value chains include feedstocks, pre-treatment, initial conversion steps, final conversion steps, and final products. Each step should be analyzed in terms of energy, resources, and waste-emission by-products. Such an analysis allows one to look at a total value system.

The concept of value chain analysis is proposed to be applied to the ORNL steam plant and could be adapted to bioenergy processes, considering feedstock supply, costs disposal costs, etc. The end goal is to quantify value in an iterative fashion in order to develop and refine the tools and questions asked as well as to justify the construction of the biomass steam plant with respect to environmental and social awareness.

A steam plant can affect the environment, the local economy, and other factors. Here, waste from forest operations is used (recycled) as something more valuable, affecting the price (value) of the waste. In order to determine the value of any product produced in the value chain, one has to define the end customer as value-chain analysis is customer centric. One of the challenges that ORNL steam plant faces is that it has multiple customer streams. Some of the customers identified are local direct steam users, the campus at large, the DOE and work-for-others sponsors, the local biomass industry, ORNL researchers who can use it for research opportunities, and the general public. One can use a decentralized approach and evaluate the value chain for potential local customers first and then extend this model to other customers as the need arises. A supply-chain view includes the biomass source, transportation, manufacturing, and consumer demand while the value chain view, considers the activities associated with acquiring biomass and converting this into value added steam that can be used for various applications around ORNL campus. Additional by products and wastes result from steam generation processes, the objective of the study is to create value map for the biomass-based steam generation plant at ORNL, identify and quantify value and non-value added activities (both primary and secondary), and determine the true value of the biomass steam plant.

The goal of the study is to develop prototype value chain analysis tool and demonstrate value-chain analysis for use in the development of sustainable bioenergy strategies, where value takes into account simultaneously multiple dimensions of sustainability – economic, environment, and social. There is a wealth of data that will become available from the ORNL steam plant on the process (feedstock variability, mass and energy balance, operation transients, and steam output and quality); economic factors (wood feedstock prices, oil and gas prices, maintenance costs, and wood-waste displacement); and environmental factors (emissions, waste-disposal costs, regulatory permits and fines, other waste disposal, and public relations). This data can be used to set up a value chain analysis model/tool, demonstrate value-chain analysis, and evaluate the value of the steam generated along with other byproducts from this biomass steam plant. Value-chain analysis will go well beyond evaluating economic justification to assessing (for example):

- Value of use of Oak Ridge Reservation wood harvested in a sustainable fashion to displace external biomass feedstock – developing a method for sustainable harvesting of site forest and/or using of switch grass
- The hidden environmental and economic implications in landfilling ash
- The intrinsic value of waste streams (e.g., ash) as products or feedstock
- The use of steam-plant wastewater to displace fresh water
- The use of intermediate streams diverted to alternate value-added byproducts

Knowing the true value and the dependencies (biomass, operations, waste management, steam uses, etc.) will lead to the development of a sustainable operations strategy for the biomass steam plant – based on changing economic conditions, environmental taxes, biomass availability and cost, etc.

Presentation Slides