Beware of the Gray to be Green

Donald R. Keer
Consulting Engineer

As companies strive to improve energy consumption, promote environmental responsibility and improve the use of sustainable fuel sources to either generate revenues or improve their bottom lines the risks are not always in the determination of capital budgets, project scheduling or execution but in the gaps between technology unit operations. Renewable energy facilities can have a dozen or more process unit operations, each with proven technologies yet at the unit interfaces the process can break down leading to reduced efficiencies, higher than expected start-up costs and lost profits.

Renewable energy comes in many forms. There are fuels such as ethanol and biodiesel which support existing engine and transportation technologies. There are also electrical generation operations such as biomass, animal waste and municipal solid waste which recycle waste streams into a cleaner form of energy. In both of these areas the objective is to reduce the amount of "new" carbon released into the atmosphere and reduce greenhouse gases. While most of the technologies employed today are well established it is at the interface between technologies a project can fail.

A recent example is an electrical generation system which used gasification of biomass pellets formed from animal waste. The initial drying process supplied as a turnkey unit exceeded expectations during start-up. The dryers efficiently removed moisture down to less than 10% by mass. Once the material reached the pelletizing process it was found to be too dry to form pellets. This issue required process re-design in the middle of the commissioning process delaying start-up and resulting in substantial revenue losses.

Another example occurred quite frequently in the biodiesel boom during the past few years. Claims by reactor designers focused on transit time within the reactor unit operation. While these reactors did improve mixing they did not catalyze the reaction to force it to completion any faster. The chemical reaction constants are independent of the mechanical mixing. Completion

of the reaction still takes 0:30 minutes to 1 hour depending on the conditions. The low transit time within the reactor itself just transferred to completion of the reaction downstream to the separation processes. Separation of product and glycerin took longer and required more storage volume. The largest issue created by the low transit time reactors was that they were sold at a significant premium over a traditional constant stir tank reactor traditionally used.

As projects move forward it is wise to review the unit operations interface. A proven technology base makes the planning, budgeting and construction easier. The issues arise because the material being handled can change day to day and the operations are being placed in new configurations. A well planned and executed project can experience significant cost over runs and delays at the very end of construction, start-up and commissioning because of required process modification discovered during the end of the project.