HOW MUCH ENEGY DOES IT TAKE
TO MAKE A GALLON OF SOYDIESEL?

Executive Summary

Vegetable oil extracted from soybeans are widely used both as food and industrial products. Recently soy oil has been processed into a viable substitute for diesel fuel. Popularly known as soydiesel, this fuel is beginning to move into the marketplace.

To aggressively encourage the use of soydiesel the public must be assured that soydiesel will constitute a positive addition to our national energy supply. This assurance depends, in part, on the energy balance of soydiesel. How much energy does it take to grow soybeans and process the beans into various products and does the energy contained in the final products exceed the energy used to make the final products? These are the questions addressed by the Institute for Local Self-Reliance (ILSRO).

The report is divided into four sections.

- How much energy is used to grow the soybeans?
- How much energy is used to extract and refine oil from the beans?
- How much energy is used to process the soy oil into a diesel fuel alternative?
- How much energy is contained in soydiesel and the two co-products -- soy meal and glycerine – produced by these processes.

ILSR's report is based on three scenarios. The first, called *National Average*, relies on average energy use on the farm and in industry. The second, called *Industry Best*, is based on the most energy conserving farm and industry practices. The third scenario, called *Industry Potential*, assumes that farmers and industry integrate into their operations all state-of-the-art energy efficiency practices.

Figures 1, 2, and 3 present a visual picture of the results of our investigation. Table 1 presents the overall information from the three scenarios.

The conclusion is that soydiesel is a net energy generator. Based on national averages, the growing and harvesting of soybeans, oil extraction and refining, and the processing of oil into a diesel fuel substitute consumes 91,921 Btus per gallon of soydiesel produced. A gallon of soydiesel alone contains 132,902 Btus per gallon.

Therefore, even without assigning any energy value to the two co-products produced in this process, soy mean and glycerine, the soydiesel net energy balance is a favorable 40,981 Btus per gallon. This translates into an energy output/input ratio of 1.44:1, and a 44 percent net energy gain.

A more realistic energy balance analysis would take into account the energy value of soy meal and glycerine. In both cases ILSR used an energy value based on the energy that otherwise would have been needed to make an equivalent animal feed or synthetic glycerine.

When energy credits for co-products are included, the net energy benefit rises to 98,239 Btus per gallon, an output/input ratio of 2.51 to 1. For every 1 Btu of energy consumed in growing soybeans and processing the beans into final products 2.51 Btus of equivalent energy is “generated” – a net energy “gain” of 1.51 Btus.

Assuming the soybeans are grown by the most energy conserving farmer and processed into final products by the most energy conserving existing industrial plants, soydiesel’s net energy benefit can be as high as 3.24 to 1.

If farmers and industry adopt state-of-the-art technologies and techniques, the net energy benefits can be about 4.1 Btus output for every 1 Btu of input energy. Most of this improvement occurs in reducing energy used in the extraction, refining and esterification of the vegetable oil into soydiesel.