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# New Life Cycle Profile Shows U.S. Soybean Production and Processing Delivers Significant Greenhouse Gas Reductions



The United Soybean Board (USB) released a new peer-reviewed life cycle profile in February that documents multiple energy and environmental benefits of U.S. soybean farming and processing. It confirms why manufacturers are increasingly using U.S. soy in green chemistry for a wide array of biobased products.

Renewable by nature, U.S. soy is used as an ingredient in a diverse group of biobased products. They range from biodiesel that fuels vehicles, to the resins that go in the exterior panels of cars and farm machinery, to spray foam insulation for buildings, to lubricants for many uses.

“This profile is the first comprehensive life cycle study covering U.S. soybean production through four major biobased products,” said Wynne, Arkansas soybean farmer John Cooper, a USB Director and Member of the USB Domestic Marketing Committee. “U.S. soy already delivers environmental and energy benefits. It’s exciting to see the trends point to even more in the future.”

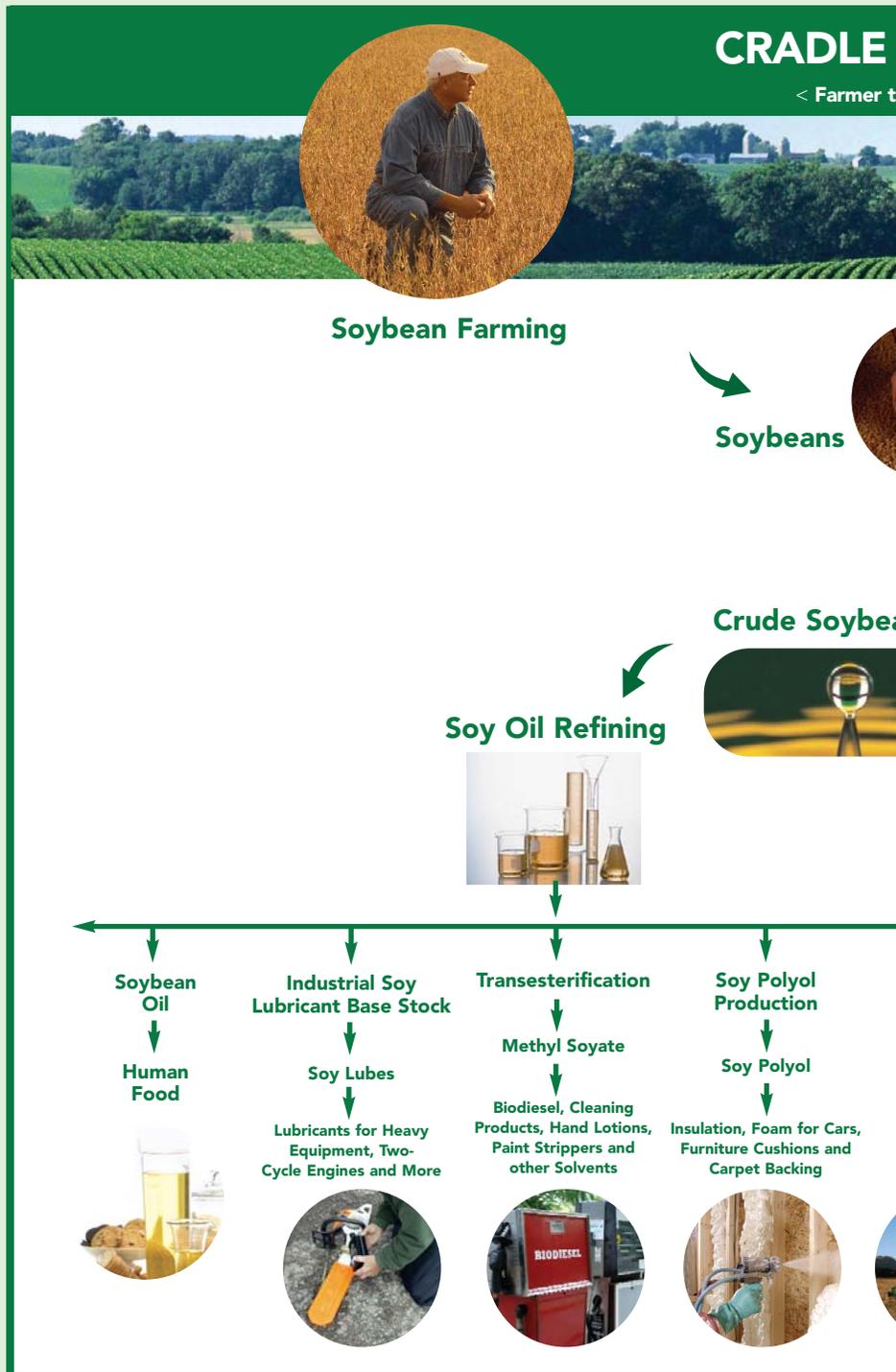
Omni Tech International, Ltd conducted the study for the United Soybean Board. Four Elements Consulting, LLC performed the life cycle assessment modeling. A group of international reviewers verified the project was performed in accordance with International Organization for Standardization (ISO) 14040/44 Life Cycle Requirements. Reviewers included Dr. Martin Patel of Utrecht University and Michael Levy of the American Chemistry Council.

A key objective was to update life cycle inventory (LCI) databases for soybean production and processing as well as conversion into four key soy-derived feedstocks (methyl soyate, soy lube base stock, soy polyol, and soy resin) used in fuel and industrial products. Its cradle-to-gate scope begins with soybean farming (the cradle) and goes through processing of products (the gate).

Currently, the data included in the Department of Energy's U.S. Life Cycle Inventory is based on three years, 1998 to 2001. This project is based on U.S. agricultural data for the 2001-2007 period. It also contains actual data on soybean processing, commonly known as crushing, that was not previously available.

## Key findings on soybean production and processing:

**Significant greenhouse gas reductions are identified through soybean production.** As soybeans grow, they remove greenhouse gases from the atmosphere. The 3.36 billion bushels of soybeans grown in the United States in 2009 removed the carbon equivalent of taking 21 million cars off the road when the figures are computed using the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator.



# U.S. Soy Delivers Environmental & Energy Benefits

*one ton of soy is equivalent to taking 21 million cars off the road*

**Soybean yields are on the rise.** The average soybean yield for 2004-2007 was 42.3 bushels per acre. This represents a 12 percent increase over the data (1998-2000 average) used in the current U.S. LCI database. This is consistent with other analysis that found plant breeders have succeeded in increasing the yield potential of soybeans by an average of 0.41 bushels/acre per year for the past 35 years. Meanwhile, plant breeding companies anticipate new soybean varieties will allow farmers to increase soybean yields by 40 percent in the next decade.

**The calculated release of nitrous oxide (N<sub>2</sub>O), a greenhouse gas, is 85% less** than the data contained in the current U.S. LCI Database due to a corrected emission factor issued by the International Panel on Climate Change (IPCC) in 2006.

**The updated data show approximately 20% less direct energy used in soybean farming** due to reduced diesel and gasoline usage.

**Soybean processing facilities reduced their energy consumption by 45%** compared to 1998 data.

## TO GATE

Product >



### Soybean Processing

Soybean Oil (20%)



Soybean Meal (80%)



Soy Resin Production

Soy Resin

Vehicle and Equipment Exterior Panels



Animal Feed



Human Food



Also, as part of the study, a life cycle impact assessment (LCIA) was completed for each of the four soy-derived feedstocks using the updated LCI information. These LCIA's show the soy-based feedstocks each significantly reduced greenhouse gas emissions compared to their petroleum-based counterparts. In addition, all four of the soy-derived feedstocks had lower fossil fuel depletion impacts than their petroleum-based counterparts.

The study provides an important resource for companies to update life cycle assessments on their specific products made using U.S. soy.

"The United Soybean Board's study sheds even more light on why biodiesel is good for the environment," says National Biodiesel Board Director of Sustainability Don Scott. "Biodiesel production and use recognizes and builds on this progress."

For example, biodiesel production facilities reduced their energy consumption by 27% compared to the 1998 data. Biodiesel has even more benefits when one calculates the emissions reductions when it is used to fuel a vehicle.

"Using rapidly renewable materials feels like the right thing to do," says Ashland Performance Materials Product Manager Bob Moffit. "The LCA provided by Omni Tech allows Ashland to show our customers that using ENVIREZ<sup>®</sup> rapidly renewable content resin not only feels right, but truly improves the environmental profile of their products and reduces the reliance on traditional petrochemical-based resins."

"At BioBased Technologies<sup>®</sup> we develop, manufacture and sell renewable-content polyols for the polyurethane industry," says Sales Manager for Polyols, Shelly West. "We believe this LCA information from USB and Omni Tech will help our customers see the bigger life cycle perspective to improve their product sustainability profile by choosing renewable-based materials that are price and performance competitive and made in the U.S.A."

More details about the study are available at [www.soybiobased.org](http://www.soybiobased.org)

# Key Findings on Soybean Production and Processing



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## **Soybean Yields Rising –**

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## **U.S. SOY DELIVERS ENERGY AND ENVIRONMENTAL BENEFITS**

Go to [www.soybiobased.org](http://www.soybiobased.org) to download documents related to the New Life Cycle Profile for Soy Products.

The entire project was peer reviewed in accordance with International Organization for Standardization (ISO) 14040/44 Life Cycle Requirements.



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Because of the potential for biobased products to create new markets for soybeans, U.S. soybean farmers have invested millions of dollars to research, test and promote biobased products. Much of this work was done through the United Soybean Board (USB), which is composed of 68 U.S. soybean farmers appointed by the U.S. Secretary of Agriculture to invest soybean checkoff funds. As stipulated in the Soybean Promotion, Research and Consumer Information Act, USDA's Agricultural Marketing Service has oversight responsibilities for the soybean checkoff.

