25% Renewable Energy for the United States By 2025: Agricultural and Economic Impacts

The University of Tennessee
Agricultural Economics

by

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Executive Summary

This study was designed to determine the feasibility of America's farms, forests and ranches providing 25 percent of U.S. total energy needs while continuing to produce safe, abundant and affordable food, feed and fiber. In addition, the analysis looks at the associated impacts of achieving the goal on the agricultural sector and the nation's overall economy. The 25x'25 Project Steering Committee established the "25x'25" vision and, along with Energy Future Coalition and the Energy Foundation, financed the study. The analysis was conducted by a team of professors and analysts from the University of Tennessee (UT) during 2005-2006

According to the U.S. Dept. of Energy (DOE), estimated energy use in 2005 was 100.5 quads. Based on DOE estimates and a recent RAND study, the nation will annually consume about 117.7 quads of energy by 2025. A quad is a quadrillion BTUs. To put a quad in perspective, about 4.4 million households would consume a quad of energy through electricity and gasoline use in one year.

To meet the 25x'25 vision, 25 percent of the projected 117.7 quads, or 29.42 quads (henceforth referred to as the "All Energy" or AE scenario), are needed from renewable energy sources. At present, an estimated 1.87 quads are produced from biomass (agricultural/forestry) resources in the production of electricity and/or heat. Based on information from the RAND study, it is estimated that, by 2025, 12.10 quads will be annually produced from geothermal, solar photovoltaic, hydro, and wind generation. The sum of those two is 13.97 quads. Therefore, to meet the 25x'25 goal of 29.42 quads, an additional 15.45 quads would need to come from agricultural and forestry lands.

A second scenario examining the impacts of producing 25% of the nation's electric power and motor vehicle fuels (hereafter the "EPT" scenario) was also performed, to parallel the findings of the RAND report. This scenario produced smaller benefits than the "All Energy" case, with smaller effects on land use and feed crop prices.

Key findings in this analysis:

- **America's farms, forests and ranches can play a significant role** in meeting the country's renewable energy needs.
- **The 25x'25 goal is achievable**. Continued yield increases in major crops, strong contributions from the forestry sector, utilization of food processing wastes, as well as the use of over one hundred million acres of dedicated energy crops, like switchgrass, will all contribute toward meeting this goal. A combination of all of these new and existing sources can provide sufficient feedstock for the additional 15.45 quads of renewable energy needed.
- **The 25x'25 goal can be met while allowing** the agricultural sector to reliably produce food, feed and fiber at reasonable prices.
- **Reaching the goal would have an extremely favorable impact on rural America and the nation as a whole**. Including multiplier effects through the economy, the projected annual impact on the nation from producing and converting feedstocks into energy would be in excess of $700 billion in economic activity and 5.1 million jobs in 2025, most of that in rural areas.

- **By reaching the 25X'25 energy goal**, **the total addition to net farm income could reach $180 billion**, as the market rewards growers for producing alternative energy and enhancing our national security. In 2025 alone, net farm income would increase by $37 billion compared with USDA baseline projections.
- **Reaching the goal would also have significant positive price impacts on crops.** In the year 2025, when compared with USDA baseline projections, national average per bushel crop prices are projected to be $0.71 higher for corn, $0.48 higher for wheat, and $2.04 higher for soybeans.
- **With higher market prices, an estimated cumulative savings in government payments of $15 billion could occur**. This does not include potential savings in fixed/direct or Conservation Reserve Program (CRP) payments.
- **In the near term, corn acres are projected to increase**. As cellulosic ethanol becomes commercially viable after 2012, the analysis predicts major increases in acreage for a dedicated energy crop like switchgrass.
- **The higher crop prices do not result in a one-to-one increase in feed expenses for the livestock industry**. Increases in ethanol and biodiesel production result in more distillers dried grains (DDGs) and soybean meal, which partially compensate for increased corn prices. Moreover, the integrated nature of the industry allows for the adjustment of animal inventories as a way to adjust to the environment and increase net returns. In addition, the production of energy from manure and tallow could provide additional value for the industry.
- **Contributions from America's fields, farms and forests could result in the production of 86 billion gallons of ethanol and 1.2 billion gallons of biodiesel**, which has the potential to decrease gasoline consumption by 59 billion gallons in 2025. **The production of 12.83 quads of energy from biomass and wind sources** could replace the growing demand for natural gas and coal-generated electricity. These renewable energy resources could significantly decrease the nation's reliance on foreign oil and fossil fuels, and enhance the national security of all Americans.

Methodology:

This type of cutting-edge research on the economics of alternative energy required the UT to combine two computer models in order to provide a comprehensive outlook at both the agricultural sector and the national and state economic impacts. A computer simulation model, POLYSYS, and an input-output model, IMPLAN, were used for the study. POLYSYS has been used for a number of national agricultural studies that require projections on the impacts on agricultural acreages and production by U.S. Agricultural Statistical Districts as the result of federal farm policy changes. IMPLAN contains state-level input-output models that provide an accounting of each state's economy.

Forest residues, mill wastes and small diameter feedstock (from thinning forests to reduce fuel for fires) comprise the woody biomass feedstocks evaluated in the study. The nation has over 400 million acres of privately owned forest land, with over 40 million of these acres in plantation forests. This forest resource could provide additional woody feedstocks. A study focusing on these additional feedstocks should be conducted.