

25% Renewable Energy for the United States by 2025: An Analysis on Jobs Created By Meeting This Goal

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September 2011





The findings and views expressed in this study are those of the authors and may not represent those of the Department of Agricultural and Resource Economics.

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Summary:

Reaching the 25x'25 vision of meeting 25% of the nation's energy needs with renewable energy by 2025 would have a favorable economic 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 renewable energy would be in excess of \$640 billion in economic activity and 4.7 million jobs in 2025, most of those in rural areas. While all the states see increases, the top 15 states with economies projected to benefit most in terms of jobs from the development of a renewable energy sector include: Missouri (240,800), Illinois (201,000), Iowa (196,300), Nebraska (161,500), Texas (159,000), Tennessee (155,700), Kentucky (148,500), Kansas (125,200), Minnesota (124,600), Oklahoma (122,500), Arkansas (109,200), Indiana (106,400), Virginia (85,000), Mississippi (84,500), and West Virginia (75,800).

By 2015, an estimated 1.4 million jobs would be created; by 2020, job creation grows to 2.9 million. These jobs are created as a result of economic growth – in 2015, the growth in these industries is estimated at \$208 billion and by 2020 the growth is projected at \$411 billion.

Meeting a 25x'25 Vision

Job creation is an immediate national priority. Renewable energy development at the scale necessary to meet the 25x'25 goal will create new jobs now and as many as 1.4 million jobs by 2015, 2.9 million by 2020 and 4.7 million new jobs by 2025. To meet a 25% renewable energy goal based upon the most recent U.S. Department of Energy's Energy Information Administration projected levels of energy demand would require 27.8 Quadrillion BTUs of renewable energy.¹ By comparison, in 2010 about 7.5 Quads of energy came from renewable sources (Figure 1). The renewable energy mix required would increase by 1,280% for solar, 533% for transportation fuels, 462% for geothermal, 348% for wind, and 265% for biomass for heat and energy. To achieve this goal, the nation would need to add 5.3 billion gallons of transportation fuel capacity per year and 95 billion kWhs of electricity annually over the 15 year period. While the analytical model assumed a linear growth in renewable energy, it is recognized that this is a limitation in the analysis, and in all likelihood growth would accelerate as technology

¹ This report provides projections of jobs that may be created as a result of meeting the 25x'25 vision, 25% renewable energy by 2025. A previous report, published in 2006, was based on Energy Information Administration (EIA) energy demand projections that required 29 Quads of energy from renewable sources to meet the 25% renewable energy goal set by 25x'25. A 2006 report provided projections that the 25x'25 vision can be accomplished and the associated economic impacts that are likely to occur if such a goal is attained.

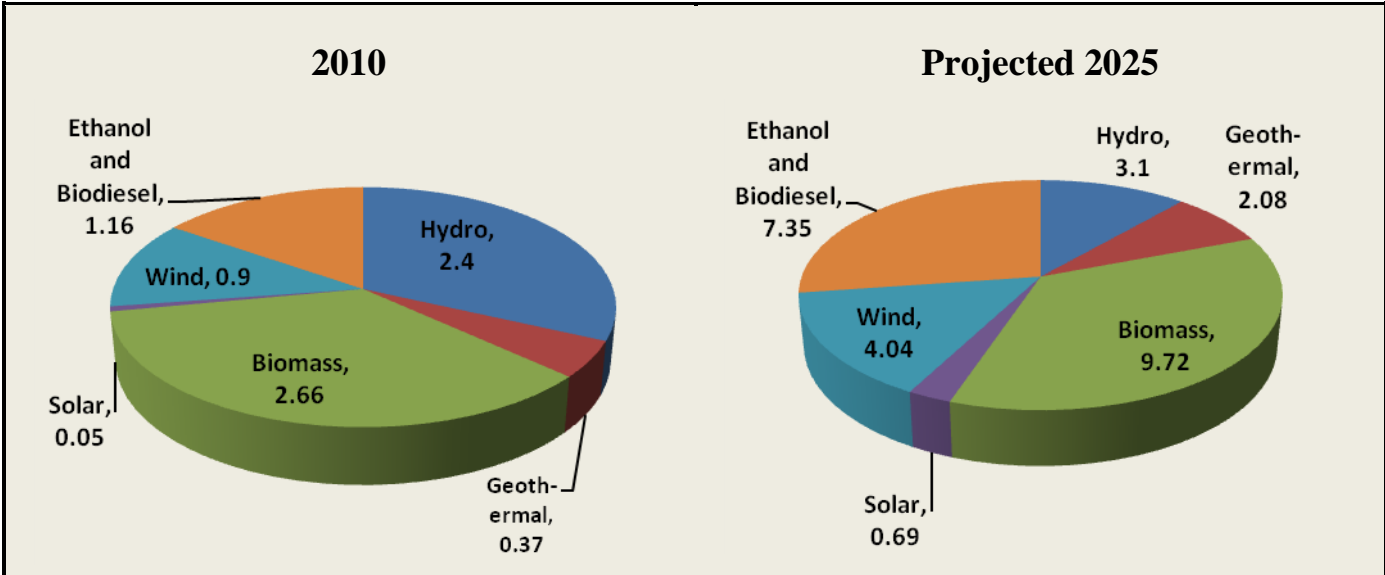


Figure 1. Actual and Projected Renewable Energy Production in Quadrillion BTUs, 2010 and 2025.

advancements occur. Furthermore, the analysis was conducted to meet the 25x'25 goal. No particular policy to achieve the goal was assumed.

Growth of the renewable energy sector to meet a 25x'25 vision could stimulate economic activity and add millions of jobs, particularly in rural areas where much of the renewable energy potential lies (Figure 2). These economic impacts would occur both from investment in new facilities and year-to-year operations of supply feedstock and operating conversion facilities.² The impacts on the nation's economy from growth in the renewable energy industry are projected to be widespread. However, the

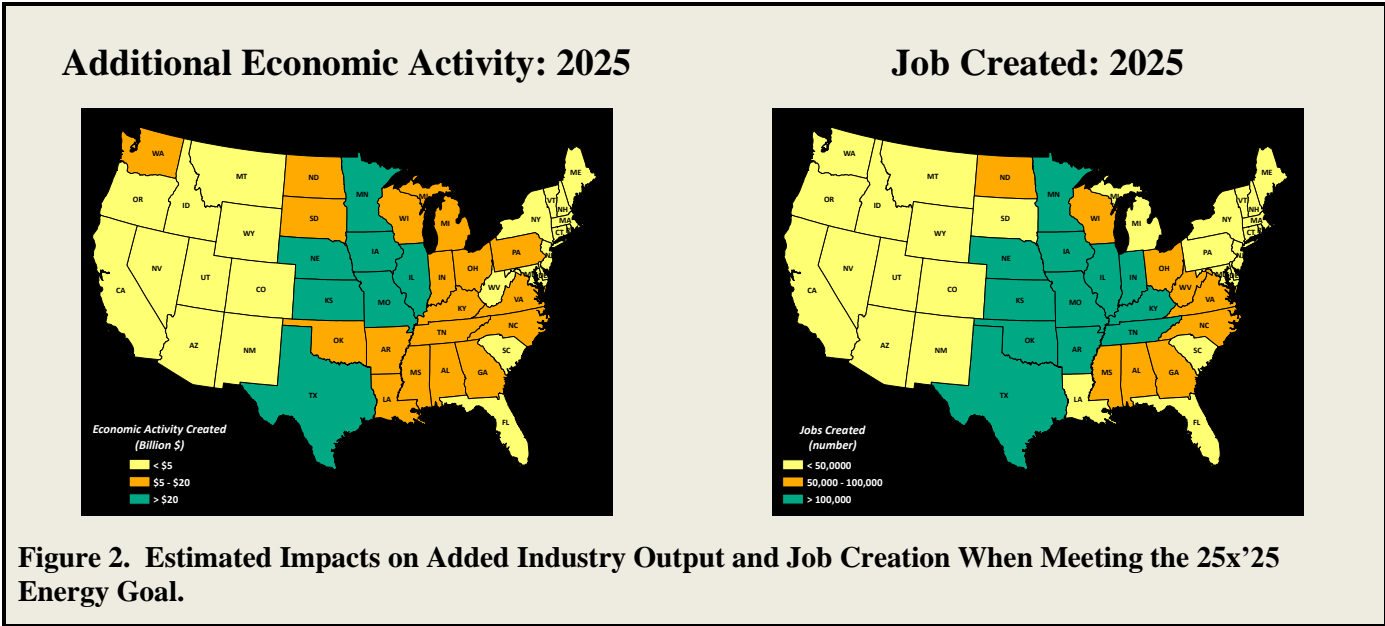


Figure 2. Estimated Impacts on Added Industry Output and Job Creation When Meeting the 25x'25 Energy Goal.

² IMPLAN is an input-output model and was used to determine the economic impacts that the 25% renewable energy goal would have on the nation's economy, including job creation.

individual state's natural resource base provides differing impacts at that level. Some states benefit from their wind and /or solar resources while others benefit from their ability to supply biomass.

Economic Impacts from Annual Operations

By 2025, \$231 billion are directly generated in the economy by growing and collecting/harvesting the feedstocks, harnessing the sun, wind, water, and heat from the earth, purchasing inputs, adding value to those inputs, and supplying the energy (Table 1). These expenditures multiply through the economy, both through purchases of inputs and services by the renewable energy sector, and through expenditures from the additional income created in the economy. The total impact to the nation's economy, including these multiplier effects, is estimated at slightly more than **\$646 billion** annually, creating an estimated **4.7 million jobs**.³ In 2015, an estimated **1.4 million jobs** are created; by 2020, job creation grows to **2.9 million**. These jobs are created as a result of economic growth – in 2015, the growth in these industries is estimated at **\$208 billion** and by 2020 the growth is projected at **\$411 billion**.

Because of its role in supplying feedstock needed to support a renewable energy industry, the agricultural sector is impacted. These impacts translate to jobs spread across the U.S., many of which occur in rural areas. As a result of supplying energy feedstocks and the associated impacts to land use, change in commodity prices and government payments, the agricultural production sector has an estimated impact of **\$156 billion** on the nation's economy in 2025. As a result of changes in the agricultural sector, Illinois, Iowa, Missouri, and Nebraska receive annual benefits in excess of **\$10 billion** (Figure 3). An estimated **\$490 billion** are generated annually in the conversion of renewables to energy. Assuming the renewable energy sector is developed in close proximity to the feedstocks, the states that receive the greatest benefit are Illinois and Iowa, with economic impacts from the renewable energy sector estimated at over **\$20 billion** (Figure 3). In

Multiplier Effects on the Economy

Expenditures by renewable energy and/or agricultural equipment manufacturers and suppliers for goods and services, land, labor, capital equipment, and other materials enhance the local economy and local tax base. Economic benefits generated in a region from these activities can be measured in terms of number of jobs created and the amount of personal income accruing to residents. These impact measures can be further broken down into *direct*, *indirect*, and *induced* (or *ripple*) effects.

Total economic impacts attributable to increased business activity are computed as the sum of the direct, indirect, and induced effects. *Direct* effects are those attributable specifically to the new expenditures in a region (renewable energy and/or agricultural equipment manufacturers and suppliers). *Indirect* effects arise from businesses' expenditures on raw materials, supplies, and other operating expenses, which help to support jobs in other local businesses. *Induced*, or ripple effects, are created as the new household income generated by the direct and indirect effects is spent and re-spent within the local economy. These impacts are measured for total economic activity and jobs.

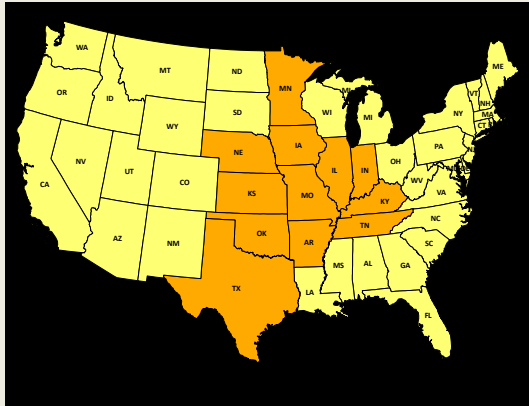
³ Since the 27.8 quads of energy created by the renewable energy sector would have limited impact on current production levels, any reduction in economic activity resulting from current energy industry displacement is minimal and no adjustments were made to the current energy sectors.

addition, Indiana, Kansas, Minnesota, Missouri, Nebraska, and Texas receive over **\$10 billion** in increased economic activity. Interstate commerce associated with conversion that cannot be assigned to any individual state is nearly equal to impacts that are allocated. Including both allocated and unallocated economic activity, **3.1 million jobs** are estimated to be created from the development of a renewable energy sector beyond what exists today.

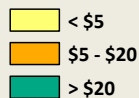
Table 1. Estimated National Economic Impacts from Annual Operations and Renewable Energy Sector Investments, 2011 through 2025					
Impacted Sector	Change in Economic Activity		Jobs Created		
	Direct Impact	Total Impact	Direct Impact	Total Impact	
	<i>Million</i>		<i>Number of Jobs</i>		
Operations:			2015		
Agricultural Production Sector	\$15,353	\$25,307		149,435	251,812
Renewable Energy Sector	\$45,891	\$95,621		28,724	492,684
Intrastate Commerce ^a	\$0	\$87,500		0	676,596
Total:	\$61,244	\$208,428		178,160	1,421,092
			2020		
Agricultural Production Sector	\$52,127	\$78,874		491,968	759,804
Renewable Energy Sector	\$85,289	\$173,440		56,755	899,268
Intrastate Commerce ^a	\$0	\$159,103		0	1,229,078
Total:	\$137,416	\$411,417		548,723	2,888,150
			2025		
Agricultural Production Sector	\$104,231	\$156,361		1,074,512	1,604,417
Renewable Energy Sector	\$127,258	\$257,545		85,640	1,338,846
Intrastate Commerce ^a	\$0	\$231,994		0	1,793,565
Total:	\$231,489	\$645,900		1,160,151	4,736,828
Investment:			2011 through 2025		
Renewable Energy Sector	\$176,615	\$693,990		1,279,661	5,521,416
^a Interstate Commerce represents economic activity from outside the state but within the U.S. It is estimated by aggregating state level impacts and comparing those impacts to the impacts estimated at the national level.					

Feedstock Production Sector

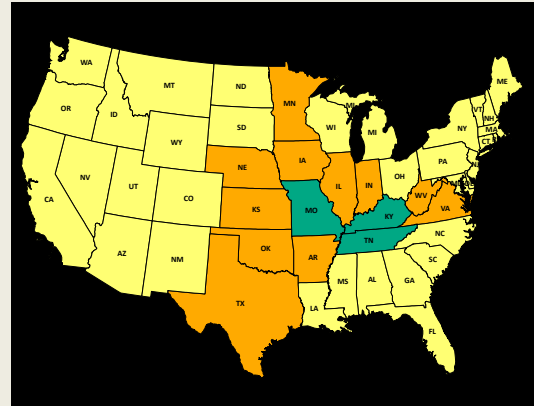
Additional Economic Activity: 2025



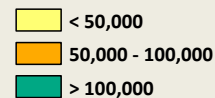
*Economic Activity Created
(Billion \$)*



Jobs Created: 2025

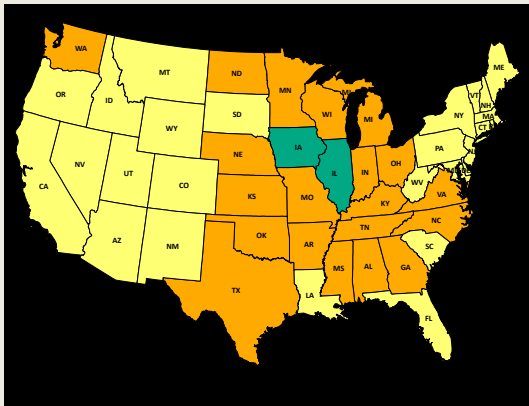


*Jobs Created
(number)*



Renewable Energy Sector

Additional Economic Activity: 2025



Jobs Created: 2025

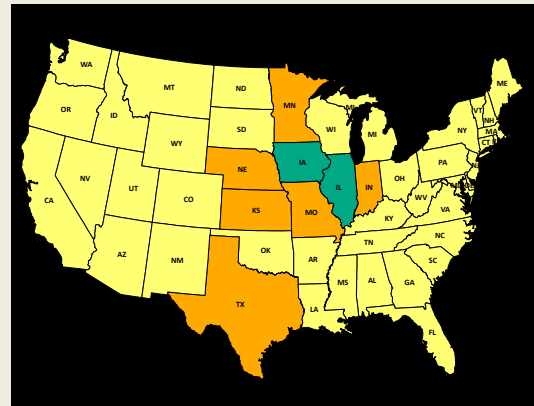


Figure 3. Estimated Impacts as measured through Additional Economic Activity and Jobs Created as a Result of the Feedstock and Renewable Energy Conversion Sectors in Meeting the 25x'25 Energy Goal.

Economic Impacts from Investment in Facilities⁴

When projected investment impacts are examined, **\$177 billion** are added directly through the development of the renewable energy sector and **\$694 billion** in industry output are added to the

⁴ Investment impacts are not annual impacts. They occur during the construction phase of a renewable energy facility.

nation's economy when the multiplier effects are considered. Nearly **1.3 million** additional **jobs** are added directly and **5.5 million jobs** are added when including multiplier effects. Of this, by 2015, \$32 billion are projected to be invested in renewable energy facilities, creating \$130 billion in economic activity and over 1 million one time jobs.

25x'25 Take Home Messages

Job Growth

- By 2015, an estimated 1.4 million jobs would be created; by 2020, job creation grows to 2.9 million. These jobs are created as a result of economic growth – in 2015 and 2020, the growth in these industries is estimated at **\$208 billion and \$411 billion**, respectively.
- By 2025, annual operations of the renewable energy sector could add as many as **4.7 million jobs** across the U.S. These jobs would result from production of the feedstocks, conversion to renewable energy, and associated multiplier effects throughout the economy.
- These jobs would be widespread throughout the U.S, with many rural areas benefitting due to economic activity from feedstock production.
- While all states are expected to gain jobs, the top 15 are: Missouri (240,800), Illinois (201,000), Iowa (196,300), Nebraska (161,500), Texas (159,000), Tennessee (155,700), Kentucky (148,500), Kansas (125,200), Minnesota (124,600), Oklahoma (122,500), Arkansas (109,200), Indiana (106,400), Virginia (85,000), Mississippi (84,500), and West Virginia (75,800).

Net Farm Income

- 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 extended projections. From a state perspective, Iowa could add \$3.3 billion per year. The top 15 states gaining jobs from feedstock production activities are: Missouri (149,400), Tennessee (120,000), Kentucky (102,200), Texas (95,100), Iowa (95,000), Illinois (91,400), Oklahoma (85,500), Nebraska (78,500), Kansas (63,100), West Virginia (62,200), Arkansas (61,100), Minnesota (58,500), Virginia (57,400), Indiana (51,000) and Mississippi (48,700).

National Security

- The production of 15.45 quads of energy from biomass could replace the growing demand for gasoline, natural gas, diesel, and/or coal generated electricity. In addition, nearly 7 quads of energy are generated from solar and wind resources. These renewable energy resources could significantly decrease the nation's reliance on foreign oil, fossil fuels, and enhance the national security of all Americans.

- Each state participates in the generation of energy with Texas leading the way, generating an additional 1.27 quads of energy from renewable sources. Other states that increase renewable energy by more than 0.5 quads include Nebraska, Kansas, Iowa, North Dakota, Minnesota, Illinois, Montana, South Dakota, Oklahoma, and Missouri.

Biofuel Production

- Contributions from America's farms, forests and ranches could result in the production of over 87 billion gallons of biofuel, which has the potential to decrease gasoline consumption by 59 billion gallons (based on Btu content) in 2025.

Finally, this document was created from information taken for the following two publications:

Burton C. English, Daniel G. De La Torre Ugarte, Kim Jensen, Chad Hellwinckel, Jamey Menard, Brad Wilson, Roland Roberts, and Marie Walsh, *25% renewable Energy for the United States by 2025: Agricultural and Economic Impacts*, The University of Tennessee, November 2006.

Burton C. English, Daniel G. De La Torre Ugarte, Kim Jensen, Jamey Menard, and Chad Hellwinckel, *25% Renewable Energy for the United States by 2025: State Agricultural and Economic Impact Tables*, The University of Tennessee, August 20, 2007.