

# Fact Sheet

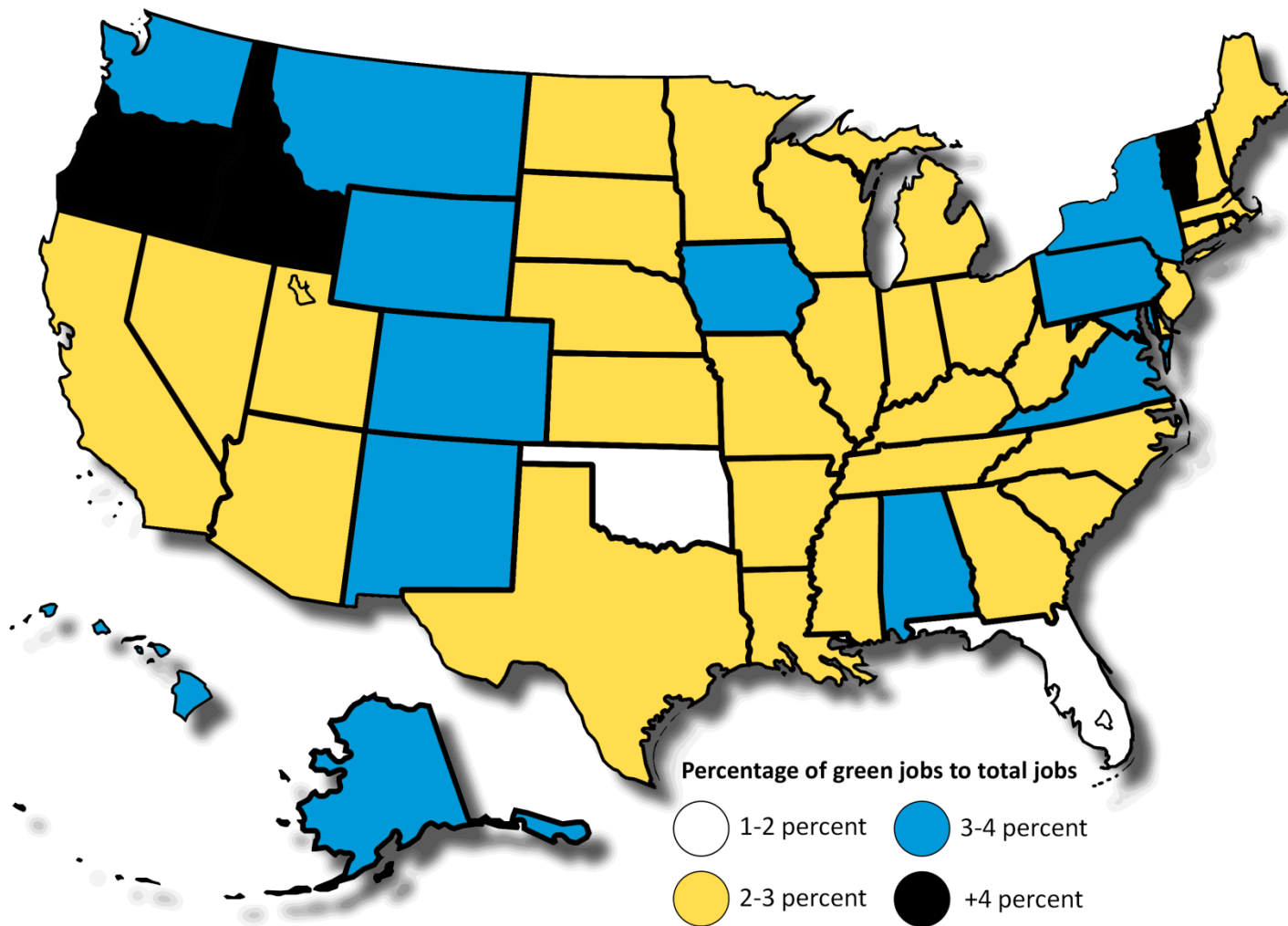
## Jobs in Renewable Energy and Energy Efficiency

June 2013

This factsheet provides the number of “green” jobs in the United States as well as a more specific consideration of employment in the renewable energy and energy efficiency sectors. According to Environmental Entrepreneurs, in 2012 alone the clean energy sector created 110,413 jobs.<sup>1</sup> Job figures in renewable energy and energy efficiency were obtained by referring to studies and reports published by the Department of Energy, the Bureau of Labor Statistics and a host of non-profits, think tanks and national trade associations.

### GREEN JOBS IN THE UNITED STATES

The following map represents the percentage of **green jobs to total jobs** in each state using the Bureau of Labor Statistics (BLS) figures on green jobs by state.<sup>2</sup>



According to a 2013 analysis by the BLS, in the fourth quarter of 2011 there were 3.4 million green jobs in the United States.<sup>3</sup> Overall, green jobs represented 2.6 percent of jobs in the United States, although, as shown in the previous map, individual states have higher or lower percentages based on their total state employment.

The BLS defines “green” jobs as those that “produce goods or provide services that benefit the environment or conserve natural resources.”<sup>4</sup> Additionally, jobs are categorized as green if the duties “involve making their establishment’s production processes more environmentally friendly or use fewer natural resources.”<sup>5</sup> The BLS definition of green jobs includes far more than just employment in the renewable energy and energy efficiency sectors. In addition, the study includes: pollution reduction and removal; greenhouse gas reduction; recycling and reuse; organic agriculture; sustainable forestry; soil, water and wildlife conservation; government and regulatory administration; education, training and advocacy related to green technologies and practices.<sup>6</sup>

A study performed by the Brookings Institution and Battelle found that 2.7 million people were directly employed in the “clean economy” in 2010, more than the 2.4 million employed in the fossil fuel industry.<sup>7</sup> The clean economy is defined as employment “that produces goods and services with an environmental benefit or adds value to such products using skills or technologies that are uniquely applied to those products.”<sup>8</sup> The Brookings-Battelle study includes: agricultural and natural resources conservation, education and compliance, energy and resource efficiency, greenhouse gas reduction, environmental management and recycling, and renewable energy.

## ENERGY EFFICIENCY & RENEWABLE ENERGY EMPLOYMENT

The following sections compile the industry specific assessments of employment in the energy efficiency and renewable energy fields from national laboratories, industry groups and non-profits. Many of the assessments include direct and indirect employment. The figures for each technology were collected from different sources; therefore there are differences in data collection methodology and specific job categorizations, which are noted in the tables below.

### Energy Efficiency

In 2008, the Lawrence Berkeley National Laboratory estimated that **380,000** people were employed in the energy efficiency services sector.<sup>9</sup> According to the American Council for an Energy-Efficient Economy (ACEEE), robust investment in energy efficiency could save \$1.2 trillion by 2020, and the United States could create 1.3 to 1.9 million jobs by 2050 through the deployment of energy efficient technologies.<sup>10</sup> Similarly, the Alliance to Save Energy (ASE) projects 1.3 million jobs by 2030.<sup>11</sup>

The following table is drawn from the Brookings-Battelle study, which has identified specific sectors within energy efficiency.<sup>12</sup> Altogether the sectors provide **823,105** direct jobs.

Type of Energy Efficiency	U.S. Job Estimates	Relation to Industry
Public Mass Transit	350,547	Direct
Energy-saving Building Materials	161,896	Direct
HVAC and Building Control Systems	73,600	Direct
Green Architecture and Construction Services	56,190	Direct
Professional Energy Services	49,863	Direct
Appliances	36,608	Direct
Energy-saving Consumer Products	19,210	Direct
Battery Technologies	16,129	Direct
Smart Grid	15,987	Direct
Electric Vehicle Technologies	15,711	Direct
Lighting	14,298	Direct
Water Efficient Products	13,066	Direct
<b>TOTAL</b>	<b>823,105</b>	

## Renewable Energy

**Biofuels:** In a report commissioned by the Renewable Fuels Association, the consulting firm Cardno-ENTRIX found that in 2012 the ethanol industry supported **383,260** jobs.<sup>13</sup> Of these jobs, more than 87,000 were direct employment and the remainder were indirect or induced.<sup>14</sup> For advanced (non-corn-based) biofuels, Environmental Entrepreneurs estimates that new refineries alone have the potential to create more than 18,000 jobs by 2015.<sup>15</sup> Furthermore, if state and federal clean fuel standards are implemented as planned, the entire advanced biofuel industry could create up to 48,000 direct, indirect and induced jobs by 2015.<sup>16</sup>

**Hydropower:** In 2010, the National Hydropower Association commissioned a Navigant Consulting report which concluded that between **200,000** and **300,000** people were employed by the U.S. hydropower industry in project development, manufacturing, project deployment, and operations and maintenance.<sup>17</sup> According to the same study, 5.3 jobs are created for every megawatt of new small hydropower installed.<sup>18</sup>

**Solar:** The Solar Foundation estimated that the U.S. solar industry employed **119,016** workers as of November 2012.<sup>19</sup> This is a 13.2 percent increase in employment from November 2011.<sup>20</sup> When considering the 2.3 percent growth rate of employment in the overall economy during this time period, the solar industry's 13.2 percent growth in employment means that the solar industry created 1 out of every 230 American jobs.<sup>21</sup>

**Wind:** According to the American Wind Energy Association (AWEA), the wind industry and related fields employed more than **80,000** Americans in 2012.<sup>22</sup> This includes jobs associated with development, manufacturing, construction and operations, as well as services provided. According to a study by Navigant Consulting, a four-year extension of the Wind Production Tax Credit (PTC) would increase industry employment to 95,000 by 2016.<sup>23</sup>

**Biodiesel:** The National Biodiesel Board commissioned a report from Cardno-ENTRIX which found that the biodiesel industry employed **64,044** people in 2012 – when direct, indirect and induced jobs are included.<sup>24</sup> The same study concluded that with the 2013 extension of the federal biodiesel tax credit, employment could increase to more than 112,000 in 2013.<sup>25</sup>

**Geothermal:** The Geothermal Energy Association (GEA) estimated in 2010 that 1.7 direct jobs and 4.25 indirect and induced jobs are created for every megawatt of geothermal capacity installed.<sup>26</sup> Based on the current installed geothermal capacity of 3,386 megawatts,<sup>27</sup> the U.S. geothermal power industry employs **20,147** people.

**Biomass Power:** According to the Biomass Power Association, the biomass power industry employs **14,000** people.<sup>28-29</sup> A 2011 REN21 study attributes a significantly higher figure of **66,000** jobs to biomass power.<sup>30</sup>

**Fuel Cells:** In February 2011, Fuel Cells 2000 estimated that 3,615 direct and 7,230 indirect jobs can be attributed to fuel cells, bringing the total to **10,845** jobs in the United States.<sup>31</sup>

**Waste-to-Energy:** The Energy Recovery Council reports that the waste-to-energy sector employs **7,000** Americans. There are 86 plants across the country.<sup>32</sup>

**Wave & Ocean Power:** According to the Brookings-Battelle Clean Economy Database, wave and ocean power employed **371** people in 2010. The sector experienced a 20.9 percent annual increase in employment from 2003 to 2010.<sup>33</sup>

The following table summarizes the job estimates for each of the aforementioned renewable energy technologies.

Type of Clean Energy	U.S. Job Estimates	Relation to Industry
Biofuels	383,260	Direct, Indirect & Induced
Hydropower	200,000 – 300,000	Direct
Solar	119,016	Direct-spend at least 50% of time working on solar
Wind	80,000	Direct & Indirect
Biodiesel	64,044	Direct, Indirect & Induced
Geothermal	25,000	Direct, Indirect & Induced
Biomass	14,000 – 66,000	Unknown
Fuel Cells	10,845	Direct & Indirect
Waste-to-Energy	7,000	Unknown
Wave & Ocean Power	371	Direct
<b>Total</b>	<b>903,536 – 1,055,536</b>	

The Brookings-Battelle study also reports job figures in renewable energy, but differs from the table above in that only direct jobs are included.<sup>34</sup> Technologies included in that Brookings-Battelle study are: hydropower, wind, solar photovoltaic, biofuels/biomass, solar thermal, waste-to-energy, geothermal, renewable energy services, and wave and ocean power. The sum total of that tally is 138,364 direct jobs.<sup>35</sup>

This fact sheet is available electronically (with hyperlinks and endnotes) at [www.eesi.org/papers](http://www.eesi.org/papers).

---

**Author: Omar Bagnied**

**Editor: Blaise Sheridan**

*The Environmental and Energy Study Institute (EESI) is a non-profit organization founded in 1984 by a bipartisan Congressional caucus dedicated to finding innovative environmental and energy solutions. EESI works to protect the climate and ensure a healthy, secure, and sustainable future for America through policymaker education, coalition building, and policy development in the areas of energy efficiency, renewable energy, agriculture, forestry, transportation, buildings, and urban planning.*

<sup>1</sup> “2012 Clean Energy Jobs Year-in-Review and Fourth Quarter Report”. *Environmental Entrepreneurs*. March 2013. <http://www.e2.org/ext/doc/E2CleanEnergy2012YearEndandQ4.pdf>. This figure includes jobs in power generation (solar, biomass, biogas, geothermal, ocean thermal, ocean wave, and tidal), manufacturing (solar, wind, energy storage, energy efficiency, electric and hybrid vehicles, vehicle fuel efficiency, public transportation, and smart grid), energy efficiency, public transportation, biofuels electric vehicles, smart grid/transmission, and public investment programs for clean energy manufacturing and job training & placement.

<sup>2</sup> News Release. “Employment in Green Goods and Services – 2011”. *Bureau of Labor Statistics*. 19 March 2013. Table 4. <http://www.bls.gov/news.release/pdf/ggqcew.pdf>.

<sup>3</sup> *Ibid.* p.1

<sup>4</sup> “The BLS Green Jobs Definition”. *Bureau of Labor Statistics*. [bls.gov/green](http://bls.gov/green). Accessed 23 November 2012.

<sup>5</sup> *Ibid.*

<sup>6</sup> Pollack, Ethan. “Counting up to green: Assessing the green economy and its implications for growth and equity”. Economic Policy Institute. 10 October 2012. <http://www.epi.org/publication/bp349-assessing-the-green-economy/>

<sup>7</sup> Muro, Mark; Rothwell, Jonathan; Saha, Devashree. “Sizing the Clean Economy: A National and Regional Green Jobs Assessment”. *Brookings Institution, Metropolitan Policy Program*. 2011. [http://www.brookings.edu/~media/Series/resources/0713\\_clean\\_economy.pdf](http://www.brookings.edu/~media/Series/resources/0713_clean_economy.pdf)

<sup>8</sup> *Ibid.*

- 
- <sup>9</sup> Goldman, Charles; Fuller, Merrian C.; Stuart, Elizabeth. "Energy Efficiency Services Sector: Workforce Size and Expectations for Growth". *Lawrence Berkeley National Laboratory*. September 2010. <http://eetd.lbl.gov/ea/emp/reports/lbnl-3987e.pdf>. Energy Efficiency Services Sector (EESS) defined as "multi-disciplinary sector that address the design and construction of homes and buildings, and the installation, use, and maintenance of high-efficiency equipment and technologies in homes, buildings, and industrial processes. The EESS includes engineers, designers, economists, marketers, and trades people. "
- <sup>10</sup> Bell, Casey J. "Energy Efficiency Job Creation: Real World Experiences". *American Council for an Energy-Efficient Economy (ACEEE)*. ACEEE White Paper, October 2012. [aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf](http://aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf)
- <sup>11</sup> Schmutter, Allyson. "Diverse Commission Unveils Plan to Double U.S. Energy Productivity". *Alliance to Save Energy*. 7 February 2013. <http://www.ase.org/news/diverse-commission-unveils-plan-double-us-energy-productivity>.
- <sup>12</sup> *Ibid.* 7 p.20
- <sup>13</sup> Urbanchuk, John M. "Contribution of the Ethanol Industry to the Economy of the United States". Cardno-ENTRIX. Renewable Fuels Association. 31 January 2013. <http://ethanolrfa.org/page/-/PDFs/2012%20Ethanol%20Economic%20Impact.pdf?nocdn=1>
- <sup>14</sup> *Ibid.*
- <sup>15</sup> Solecki, Mary; Dougherty, Anisa; Epstein, Bob. "Advanced Biofuel Market Report 2012". *Environmental Entrepreneurs*. 2012. <http://www.e2.org/ext/doc/E2AdvancedBiofuelMarketReport2012.pdf>
- <sup>16</sup> *Ibid.*
- <sup>17</sup> Navigant Consulting. "Job Creation Opportunities in Hydropower". *National Hydropower Association (NHA)*. 20 September 2009. [http://www.hydro.org/wp-content/uploads/2010/12/NHA\\_JobsStudy\\_FinalReport.pdf](http://www.hydro.org/wp-content/uploads/2010/12/NHA_JobsStudy_FinalReport.pdf)
- <sup>18</sup> Degette, Diana; McMorris Rodgers, Cathy. "Senate Should Pass Hydropower Improvements". 28 November 2012. [politico.com/news/stories/1112/84345.html?hp=r5](http://politico.com/news/stories/1112/84345.html?hp=r5)
- <sup>19</sup> "National Solar Jobs Census 2012". *The Solar Foundation*. 14 November 2012. [thesolarfoundation.org/research/national-solar-jobs-census-2012](http://thesolarfoundation.org/research/national-solar-jobs-census-2012)
- <sup>20</sup> "Solar Industry Data". *Solar Energy Industries Association (SEIA)*. Accessed 5 December 2012. [seia.org/research-resources/solar-industry-data](http://seia.org/research-resources/solar-industry-data)
- <sup>21</sup> *Ibid.* 14
- <sup>22</sup> Gramlich, Rob. "Testimony before the House Energy Committee". *American Wind Energy Association (AWEA)*. 16 April 2013. [http://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-113-SY21-WState-RGramlich-20130416\\_0.pdf](http://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-113-SY21-WState-RGramlich-20130416_0.pdf)
- <sup>23</sup> "Impact of the Production Tax Credit on the U.S. Wind Market". Navigant Consulting. *American Wind Energy Association (AWEA)*. 11 December 2011. [http://www.novoco.com/energy/resource\\_files/reports/awea\\_impact\\_of\\_ptc\\_on\\_us\\_wind\\_market\\_121112.pdf](http://www.novoco.com/energy/resource_files/reports/awea_impact_of_ptc_on_us_wind_market_121112.pdf)
- <sup>24</sup> Urbanchuk, John M. "Economic Impact of Reinstating the Biodiesel Tax Credit through 2013". Cardno-ENTRIX. The National Biodiesel Board. 27 November 2012. <http://www.biodiesel.org/docs/default-source/fueling-action---tax-incentive/biodiesel-economic-impact-w-summary-2011.pdf?sfvrsn=4>
- <sup>25</sup> *Ibid.*
- <sup>26</sup> Jennejohn, Dan. "Green Jobs Through Geothermal Energy". *Geothermal Energy Association*. October 2010. [http://www.geo-energy.org/pdf/reports/GreenJobs\\_Through\\_Geothermal\\_Energy\\_Final\\_Oct2010.pdf](http://www.geo-energy.org/pdf/reports/GreenJobs_Through_Geothermal_Energy_Final_Oct2010.pdf)
- <sup>27</sup> "2013 Annual US Geothermal Power Production and Development Report". *Geothermal Energy Association*. February 2013. [http://geo-energy.org/pdf/reports/2013AnnualUSGeothermalPowerProductionandDevelopmentReport\\_Final.pdf](http://geo-energy.org/pdf/reports/2013AnnualUSGeothermalPowerProductionandDevelopmentReport_Final.pdf)
- <sup>28</sup> "US Biomass: Growing a Greener Economy". Biomass Power Association. Accessed 5 March 2013. <http://www.biomasspowerassociation.com/pages/links.php>
- <sup>29</sup> Annand, Carrie. *Biomass Power Association*. Personal correspondence.
- <sup>30</sup> "Renewables 2011 Global Status Report". *REN21*. 2011. <http://www.icafrica.org/fileadmin/documents/Knowledge/GIZ/RENEWABLES-2011-Global%20Status%20Report.pdf>
- <sup>31</sup> "A Compendium of Job Estimates in the Fuel Cell Industry". *Fuel Cells 2000*. March 2011. [http://www.fuelcells.org/wp-content/uploads/2012/02/Fuel\\_Cell\\_Industry\\_Job\\_Estimates.pdf](http://www.fuelcells.org/wp-content/uploads/2012/02/Fuel_Cell_Industry_Job_Estimates.pdf)
- <sup>32</sup> *The Energy Recovery Council*. <http://www.energyrecoverycouncil.org/faq#jobs>
- <sup>33</sup> *Ibid.* 7 p.49, Appendix A.
- <sup>34</sup> *Ibid.* p.20
- <sup>35</sup> *Ibid.* p.49, Appendix A.