



# Fact Sheet

## Jobs from Renewable Energy and Energy Efficiency

October 2009

Much attention is now given to America's need to rebuild its economy and shift the nation's energy to a low-carbon, more secure supply. The renewable energy and energy efficiency sectors can provide quality, long-term jobs that remain in the United States and help communities transition away from fossil fuel-intensive industries. Jobs in renewable energy and energy efficiency will provide income for many who have lost their jobs, and return the United States to a leadership role in the global fight against climate change. Recent energy legislation, such as the *Energy Independence and Security Act of 2007* (P.L. 110-140), as well as in the *American Recovery and Reinvestment Act of 2009* (P.L. 111-5), include provisions for new jobs that support a clean energy economy. This fact sheet provides information about the quantity and variety of current and projected clean energy jobs available in the United States and throughout the world.

### National

- According to research by Roger Bezdek for the American Solar Energy Society (ASES), the renewable energy (RE) and energy efficiency (EE) industries created more than nine million jobs (direct and indirect) in 2007; 450,000 jobs in RE and 8 million jobs in EE throughout the United States. As many as one out of four workers in the United States, representing 37 million jobs, will be working in RE or EE industries by 2030. These 37 million jobs are not just engineering-related, but also include millions of new jobs in manufacturing, construction, accounting, and management.<sup>1</sup>
- The Union of Concerned Scientists (UCS) estimated in 2007 that a national Renewable Energy Standard (RES) of 20 percent by 2020 would create 185,000 new jobs from RE development, add \$25.6 billion in income to farmers, ranchers, and rural landowners, and save consumers \$10.5 billion in electricity and natural gas bills by 2020.<sup>2</sup>
- A 2004 report from the Renewable and Appropriate Energy Laboratory in Berkeley found that RE creates more jobs per megawatt (MW) of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel energy-based sector.<sup>3</sup>
- The Center for American Progress (CAP) and Political Economy Research Institute (PERI) estimated in 2008

that a \$100 billion green investment package over two years would create nearly four times more jobs than spending the same amount of money within the oil industry, and would reduce the unemployment rate to 4.4 percent over two years.<sup>4</sup>

- A 2008 report from the U.S. Council of Mayors projected that 4.2 million new green jobs can be added to the U.S. economy by 2038.<sup>5</sup>
- The Pew Charitable Trusts found that between 1998 and 2007, jobs in the clean energy economy grew at a national rate of 9.1 percent, while traditional jobs grew by 3.7 percent.<sup>6</sup>

### States

- A 2007 study by the University of Texas reported that Texas could add 123,000 new high-wage jobs by 2020 to its economy by actively moving toward solar power.<sup>7</sup>
- A 2007 study by the American Council for an Energy-Efficient Economy (ACEEE) reported that by adopting energy efficient strategies Florida could save \$28 billion, offset the state's entire future growth in electric demand by 2023, and create more than 14,000 jobs by 2023.<sup>8</sup>
- According to Environment California, the impact of meeting California's previously enacted Renewable Portfolio Standard (RPS) of 20 percent by 2017 would create an estimated 119,000 person-years of

employment at an average salary of \$40,000. The California RPS has since been accelerated to 20 percent by 2010.<sup>9</sup>

- Environment California also forecasted in 2007 that California's Million Solar Roofs Initiative, enacted in 2006, will create 15,000 new jobs for the Golden state.<sup>10</sup>
- According to a 2008 report from the Center for Energy, Resources and Economic Sustainability at the University of California, Berkeley, California's energy efficiency policies created nearly 1.5 million jobs from 1977 to 2007, while eliminating fewer than 25,000.<sup>11</sup>
- The UCS concluded in a 2006 report that Washington's Initiative 937 (I-937), a 15 percent RPS by 2020, would create 2.6 times more jobs than "business as usual", resulting in a net increase of 1,230 jobs by 2025 for the state.<sup>12</sup>
- In a 2006 report for ASES, Roger Bezdek found that Ohio created over 500,000 total jobs in RE and EE industries in 2006.<sup>13</sup>
- A 2007 study by Global Insight Inc. for the Renewable Energy Trust reported that the clean energy sector provided over 14,000 jobs in Massachusetts in 2007, and will soon become the 10<sup>th</sup> largest sector in the state.<sup>14</sup>
- In a 2008 press release, Environment California said that investing in the CAP and PERI green recovery program would bring more than 235,000 jobs and \$12.7 billion in investments in California.<sup>15</sup>
- In 2007, new tower, blade, turbine and assembly plants for wind energy systems were announced for Arkansas, Colorado, Iowa, North Carolina, New York, and Oklahoma, which is expected to create 6,000 jobs.<sup>16</sup>
- In 2008, a report by the organizations Clean Edge, Inc. and Climate Solutions concluded that 40,000 to 60,000 new jobs could be created by 2025 in the solar photovoltaic (PV), wind, green building, bioenergy, and smart grid sectors in the Washington and Oregon region.<sup>17</sup>

## International

- According to a 2008 report by the Worldwatch Institute, there were 2.3 million people working directly or indirectly in RE industries around the world in 2006. The wind power industry employed about 300,000 people, the solar PV sector accounted for an estimated 170,000 jobs, and the solar thermal industry, at least 624,000. More than 1 million jobs were found in the biomass and biofuels sector.<sup>18</sup>
- According to the European Union Commission on Monitoring and Modeling Initiative on Targets for Renewable Energy, net employment growth in the

European Union is projected to increase to 950,000 under current RE policies, and up to 1,660,000 under the Advanced Renewable Strategy of meeting 22.1 percent of energy demand with RE by 2010.<sup>19</sup>

- The Danish Wind Energy Association reported in 2008 that 28,400 people were employed in the wind sector in 2008.<sup>20</sup>
- RE jobs in Germany shot up to 249,300 in 2007, up from 160,500 jobs in Germany in 2004.<sup>21</sup>
- According to the 2006 ASES-Bezdek report, over 214,000 people were employed in RE in Germany in 2006. Of these, 64,000 were employed in the wind industry, according to the German Wind Energy Association.<sup>22</sup>
- Jobs in wind power grew from 63,000 in 2004 to 84,300 in 2007 in Germany. The booming solar sector saw jobs grow from 25,100 in 2004 to 38,600 in 2007 as investment poured into PV production.<sup>21</sup>
- In 2006, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety reported that the German RE sector could increase to over 300,000 jobs by 2020.<sup>23</sup>
- The European Wind Energy Association reported in 2009 that Spain employed about 20,500 people directly in its wind industry in 2007.<sup>24</sup>
- Spain has seen its renewable industry expand rapidly in recent years. The industry employed some 89,000 people directly (mostly in wind power and PV) and another 99,000 indirectly in 2006.<sup>18</sup>
- In Brazil, the U.S. Agency for International Development sponsored a program to train students from the poorest neighborhoods in building RE capacity. The program has been a huge success – over 60 percent of the graduates from the 8-month long program now have jobs or are attending university full-time, and rural communities are benefiting from the new access to electricity.<sup>25</sup>
- In 2008, the Worldwatch Institute reported that Brazil's ethanol industry employed about 300,000 workers.<sup>18</sup>
- In Bangladesh, Grameen Shakti, a division of Grameen Bank, has installed more than 100,000 solar home systems in rural communities in a few years – one of the fastest-growing solar PV programs in the world – and is aiming for 1 million by 2015, along with the creation of some 100,000 jobs for local youth and women as solar technicians and repair and maintenance specialists.<sup>18</sup>
- According to the Woods Hole Research Center, India could create some 900,000 jobs by 2025 in biomass gasification.<sup>26</sup>

- In New Delhi, India, the introduction of 6,100 Compressed Natural Gas buses by 2009 is expected to lead to the creation of 18,000 new jobs.<sup>18</sup>
- *Solar Generation IV*, a 2007 report by the European Photovoltaic Industry Association and Greenpeace International, projected under the best case scenario that by 2030 as many as 6.3 million jobs could be created by world-wide solar PV development, 2.1 million jobs in wind energy, and 12 million jobs in biofuels-related agriculture and industry.<sup>27</sup>
- According to a 2008 report by the Worldwatch Institute, greening the building industry in the European Union and the United States would create at least 2 million jobs by 2030.<sup>18</sup>

## Wind

- The U.S. Department of Energy's 2008 report on 20 percent wind by 2030 estimates that 260,000 jobs will be created per year to meet the goal.<sup>28</sup>
- According to the American Wind Energy Association (AWEA), the United States has over 28,206 MW of installed wind energy capacity as of March 2009. Roger Bezdek concluded in his 2006 ASES report that in 2006 the wind industry created 16,000 direct jobs and 36,800 total jobs.<sup>29,30</sup>
- According to a 2004 study by the Renewable Energy Policy Project, a national development of 50,000-70,000 MW of wind energy could potentially create 215,000-331,000 full time equivalent job-years of employment.<sup>31</sup>
- Global Wind Energy Outlook, a report published in 2006, outlined scenarios for future worldwide wind energy development and projected global wind power employment to reach as much as 2.1 million in 2030 and 2.8 million in 2050 under the advanced scenario.<sup>32</sup>
- According to the North Carolina Wind Working Group, every 100 MW of wind power installed provides 310 full-time equivalent (FTE) manufacturing jobs, 67 contracting and installation jobs, and 9.5 annual jobs in operation and maintenance.<sup>33</sup>
- According to AWEA, 35,000 jobs were created in the wind power sector in 2008. Many of the new jobs were in manufacturing.<sup>34</sup>
- The European Wind Energy Association states that over 60,000 jobs have been created from 2004 to 2009, an average of "33 new people a day, seven days a week."<sup>35</sup>
- Vestas, the world's largest wind turbine manufacturer, employs 21,000 people representing 56 different nationalities as of 2009.<sup>35</sup>
- According to a 2004 Greenpeace report, under the highest growth scenario, employment from offshore

wind power in the United Kingdom would reach 76,000 additional full time jobs by 2020, compared to the 2003 level. The majority of these (some 64,000) would be in manufacturing and installation.<sup>36</sup>

## Bioenergy

- The ethanol industry produced 5 billion gallons of fuel and created 163,034 jobs in all sectors of the economy during 2006, according to a 2007 report by the Renewable Fuels Association (RFA). Ethanol Across America reported the creation of 5,300 jobs in Minnesota, 5,187 jobs in Iowa and 3,000 jobs in Nebraska.<sup>37,38</sup>
- According to RFA, the increase in economic activity resulting from ongoing production and construction of new ethanol capacity supported the creation of 238,541 jobs in all sectors of the economy during 2007.<sup>39</sup>
- The U.S. biodiesel industry supported more than 21,000 jobs and added \$4 billion to the national economy in 2007.<sup>40</sup>
- Assuming biodiesel growth reaches 650 million gallons of annual production by 2015, the National Biodiesel Board estimated in 2007 that an additional 39,102 jobs will be created between 2006 and 2015.<sup>41</sup>
- Biomass, which accounts for 39 percent of all RE jobs in Germany, employed 96,100 people in 2007, up from 56,800 in 2004.<sup>21</sup>
- According to the Renewable Fuels Association (RFA), the ethanol industry employed 494,177 people in 2008. RFA predicted in 2009 that the ethanol industry will create one million new jobs by 2022.<sup>42</sup>

## Geothermal

- The Geothermal Energy Association (GEA) reported 4,583 direct jobs in 2004, with an average salary of \$40,000-\$50,000.<sup>43</sup>
- The Energy Information Association projected an increase of 2,455 MW in the geothermal industry by 2026, which would create 8,764 direct jobs and 21,910 total jobs by 2026, according to GEA.<sup>43</sup>
- According to a 2006 GEA report, a 215 MW geothermal plant in California will create 550 construction jobs and create 60 permanent, full time jobs.<sup>44</sup>

## Solar

- Projected to become a \$15 billion industry by 2020, the solar energy industry employed over 20,000 people in 2001, and is expected to employ 150,000 people by 2026.<sup>45</sup>
- The Solar Energy Industries Association (SEIA) has a goal of supplying half of all new U.S. electricity

generation from the sun by 2025, creating more than 260,000 jobs by 2030.<sup>46</sup>

- An economic study by Navigant Consulting, Inc., stated that the extension of the 30 percent solar Investment Tax Credit (ITC) could result in enough direct, indirect, and induced activity to support 440,000 jobs. In addition, there would be an increase in domestic investment in the solar industry of \$232 billion by 2016.<sup>47</sup>
- A 2006 joint analysis by Greenpeace and European Photovoltaic Industries Association (EPIA) showed that if 205 gigawatts of PV systems are in place by 2020, solar energy could provide 2 million jobs worldwide.<sup>48</sup>

## Wave & Tidal

- Gavin Newsom, the mayor of San Francisco, announced in February 2009 that the city had submitted a plan to the federal government to develop a wave power project off the coast, generating between 10 to 30 MW of energy and creating 100 jobs.<sup>49</sup>
- The Wave Hub project in the UK is an attempt to create the world's first large scale wave energy farm, and has the potential to create 1800 jobs by 2034, according to a 2009 report by the Department of Business, Enterprise and Regulatory Reform.<sup>50</sup>

## Fossil Fuels

- According to data from the National Mining Association (NMA), jobs in the U.S. coal mining industry have been decreasing steadily since 1985 (184,373 jobs in 1985, down to 84,071 in 2007).<sup>51</sup>
- The Coal-to-Liquid Coalition reported that a typical 10,000 barrel/day CTL plant creates 200 direct jobs on-site, 150 jobs at supporting coal mines and 2,800 indirect jobs throughout the region.<sup>52</sup>
- According to NaturalGas.org, natural gas provides the United States with about a quarter of our energy. Data from the Department of Labor shows that distribution of natural gas employed 106,400 people in 2006.<sup>53</sup>
- UCS estimated in 2007 that requiring automakers to meet a fleet-wide average of 35 mpg by 2018 will create 241,000 additional jobs nationwide by 2020, and increase jobs in the automotive sector alone by 23,900. In 2009, President Obama ordered automakers to increase the fuel economy to 35.5 mpg by 2016.<sup>54</sup>
- According to Worldwatch Institute, U.S. coal output rose by almost one third during the past two decades, yet employment has been cut in half, totaling 79,000 in 2006.<sup>18</sup>

## Nuclear

- According to the Nuclear Energy Institute, a 1,000 MW nuclear plant creates 400-700 permanent jobs. Building a new nuclear plant would result in the creation of 1,400 to 1,800 jobs during construction.<sup>55</sup>

## Green Collar Jobs Legislation

- The *Green Jobs Act of 2007* was passed as part of the *Energy Independence and Security Act*, signed by President Bush on December 19, 2007, establishing a RE and EE Worker Training Program, a National Research Program to track energy-related workforce trends, State and National Energy Training Partnership Programs, and Pathways Out of Poverty Demonstration Programs. The programs were authorized at \$125 million a year and would be administered by the U.S. Department of Labor. The RE and EE Worker Training Program received \$1.2 billion in the *American Recovery and Reinvestment Act*, signed into law by President Obama on February 17, 2009.<sup>56</sup>
- An economic study issued in September 2008 by Navigant Consulting, Inc., shows that more than 1.2 million employment opportunities, including 440,000 permanent jobs, and \$232 billion in investment would be supported in the United States by the solar energy sector alone through 2016 if Congress extended the solar investment tax credit for eight years. (The extension was signed by the President on October 3, 2008, as part of the *Emergency Economic Stabilization Act of 2008*). Solar energy manufacturing and installation jobs are spread across the United States. The states that would see the greatest economic boom from an extended tax credit are California, Florida, Arizona, New Mexico, Nevada, New Jersey, Massachusetts, New York, Oregon, and Washington. Also, Pennsylvania, Michigan, Ohio and the rest of the Great Lakes region would benefit significantly from an expansion of the solar industry, an area hard-hit by layoffs in the automotive and traditional manufacturing industries.<sup>57</sup>
- The American Council for an Energy-Efficient Economy (ACEEE) estimates that approximately 305,000 jobs will be created by 2020, with a total of 770,000 jobs generated by 2030, from the energy efficiency provisions in H.R. 2454, the *American Clean Energy and Security Act (ACES)*, as it passed in the House in June 2009.<sup>58 59</sup>
- The energy provisions of the *American Recovery and Reinvestment Act*, signed into law by President Obama on February 17, 2009, will create more than 500,000 jobs, and accelerate deployment of smart grid technology, provide energy efficiency funds for



the nation's schools, offer support for the nation's governors and mayors to tackle their energy challenges, and establish a new loan guarantee program to keep our transition to renewable energy on track during the economic crisis.<sup>60</sup>

- The Green Jobs Innovation Fund, authorized in the *Workforce Training Act of 1998*, supports competitive

grant opportunities to help workers receive training in green industry sectors and occupations and access green career pathways. It has yet to be funded; however President Obama requested \$50 million for this program in the fiscal year 2010 budget request.<sup>61</sup>

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