

THE OUTLOOK FOR RENEWABLE ENERGY IN AMERICA

2014



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ABOUT ACORE

The American Council On Renewable Energy (ACORE), a 501(c)(3) non-profit membership organization, is dedicated to building a secure and prosperous America with clean, renewable energy. ACORE seeks to advance renewable energy through finance, policy, technology, and market development and is concentrating its member focus in 2014 on National Defense & Security, Power Generation & Infrastructure, and Transportation. Additional information is available at: www.acore.org.

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Published by:
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EXECUTIVE SUMMARY

The Outlook for Renewable Energy in America: 2014 assesses the marketplace and forecasts the future of each renewable energy technology sector from the perspectives of U.S. renewable energy trade associations. Each sector forecast is accompanied by a list of the trade association's specific policy recommendations that they believe might encourage continued industry growth.

Renewable energy has now become a technology of choice for many Americans, accounting for nearly 40% of all new, domestic power capacity installed in 2013. Presently, renewable power capacity exceeds 190 GW, biofuels are responsible for roughly 10% of our nation's fuel supply, and renewable thermal energy systems heat and cool a growing number of homes, businesses, public buildings, and other structures throughout the country. The array of technologies are either fully or increasingly cost-competitive with conventional energy sources, and costs continue to fall. Per Bloomberg New Energy Finance, private-sector investment in the U.S. clean energy sector surpassed \$100 billion in 2012–2013, stimulating economic development while supporting hundreds of thousands of jobs. The industry-specific authors of the *Outlook* forecast this growth to continue, driven by increasing cost-competitiveness with conventional generation, technology advancements, and growing acceptance by Americans to embrace clean and renewable technologies.

The impressive growth of renewable energy over the past decade is a signal that, when certain, state and federal policies have worked. Further scale up requires evolving and cost-effective policies that drive continued private-sector investment. ACORE offers the following, high-level recommendations for growth:

- Building on the success of past and present policy efforts, reinvigorate effective policies to promote market certainty, stable growth, and align federal, state, and private initiatives.
- Increase access to greater amounts of cheaper and more liquid capital by extending to renewable energy innovative financing options that are successful in motivating capital formation in other sectors.
- Promote the expansion of all proven forms of renewable energy, whether centralized or distributed power generation, transportation fuels, thermal energy, or other technologies. America needs a diverse array of options to transform its energy sector to meet 21st century needs.

- Continue support of public and private research, development, demonstration, and deployment to fuel the next generation of renewable technologies.
- Build renewable energy in tandem with enabling technologies, such as energy storage, hydrogen fuel cells, waste heat, and smart grid technologies, to enhance system effectiveness.

A number of opportunities exist at the federal, state, and local levels for industry advancement and investment; however, they are not one-size-fit-all solutions for every renewable technology. The articles in this report detail specific market drivers for the biofuel, biomass, geothermal, hydropower, solar, waste, and wind energy sectors. We applaud the unity of the renewable industry community and their united front demonstrated in *The Outlook for Renewable Energy in America: 2014*.

With the right policy mechanisms in place, the potential of America's clean energy economy extends beyond one fuel choice or pipeline, and provides the country with an unparalleled opportunity to reinvigorate our economy while protecting our environment. An America powered on renewable power, fuels, and thermal energy is a stronger, more secure, prosperous and cleaner America.





The Outlook for **WIND POWER**

The American investment in wind energy continues to pay off in the form of reduced costs, improved efficiency, and lower prices for consumers. The beginning of 2014 marked a record wave of new construction, and the American Wind Energy Association reported that wind power continues to lead the way on affordable, reliable renewable energy.



Tom Kiernan
CEO, AWEA

“In many parts of the country today[...] wind is the most economic form of new energy generation,” as NextEra Energy Chief Financial Officer Moray P. Dewhurst said on a recent earnings call.

Investments in technological advancements and stable policy have helped drive down the cost of wind energy by 43% in four years, and the industry remains on schedule to grow to supply 20% of the U.S. power grid by 2030, and beyond.

WIND POWERS OVER 4% OF U.S. GRID IN 2013

Net generation by wind energy at the start of 2014 was up 19% from the year before, bringing American wind power to 4.13% of U.S. electricity generation overall. At the state level, Iowa took the prize for largest percentage of its electricity generated from wind in 2013, at 27.38%. South Dakota finished second with 25.95%, followed by Kansas with 19.39%.

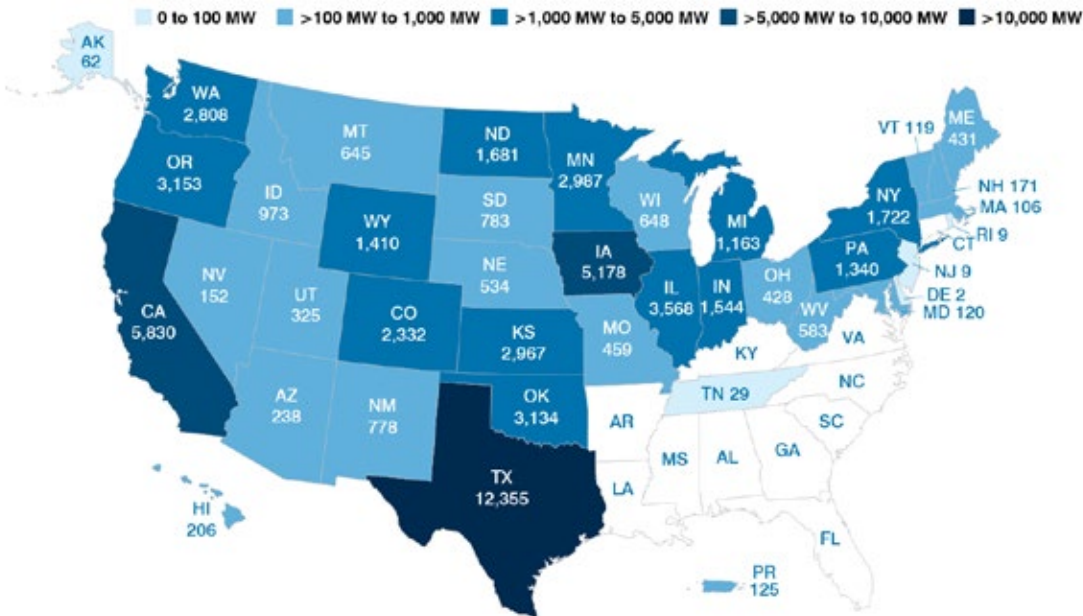
Those numbers have the chance to keep growing. As 2014 began, there were more U.S. wind power megawatts (MW) under construction than ever before in history: more than 10,900 MW started construction activity during the fourth quarter, and more than 12,000 MW are currently under construction. When completed, these 90+ projects will generate enough electricity to power an additional 3.5 million households.

On-shore projects are currently under construction in at least 20 states. There are more than 7,000 MW under construction in Texas alone—more megawatts than any other state currently has installed. Iowa has the second most megawatts under construction (1,050 MW). Other top states for construction activity include Kansas (722 MW), North Dakota (632 MW), Michigan (342 MW), and New Mexico (317 MW).

2013 was also important to the budding offshore wind industry in the United States. The University of Maine's DeepCwind Consortium deployed a quarter-scale, floating turbine in a pilot project. In addition, the U.S. Department of the Interior (DOI) held auctions for areas off Rhode Island, Massachusetts and Virginia, while Maryland passed legislation to support 200 MW of offshore wind power, and the U.S. Department of Energy (DOE) continued work on seven innovative demonstration projects.

While the impressive number of new construction projects is excellent news for the industry, the unpredictability of the federal production tax credit (PTC) in Congress is still forcing the industry into a boom-bust cycle.

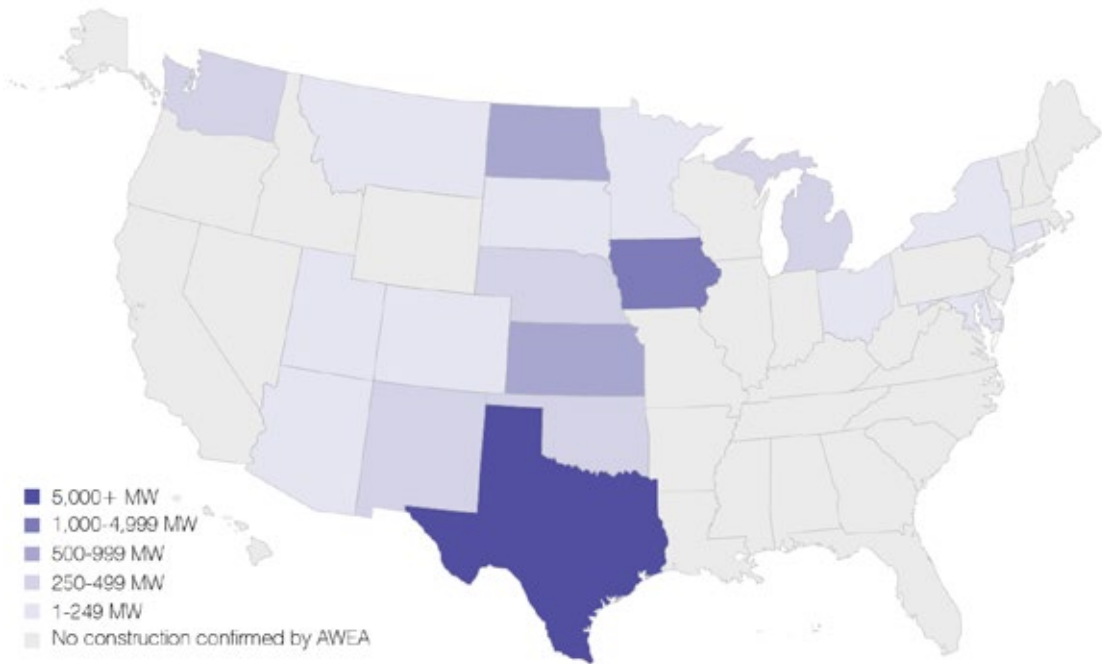
U.S. wind power capacity installations by state, 4Q 2013



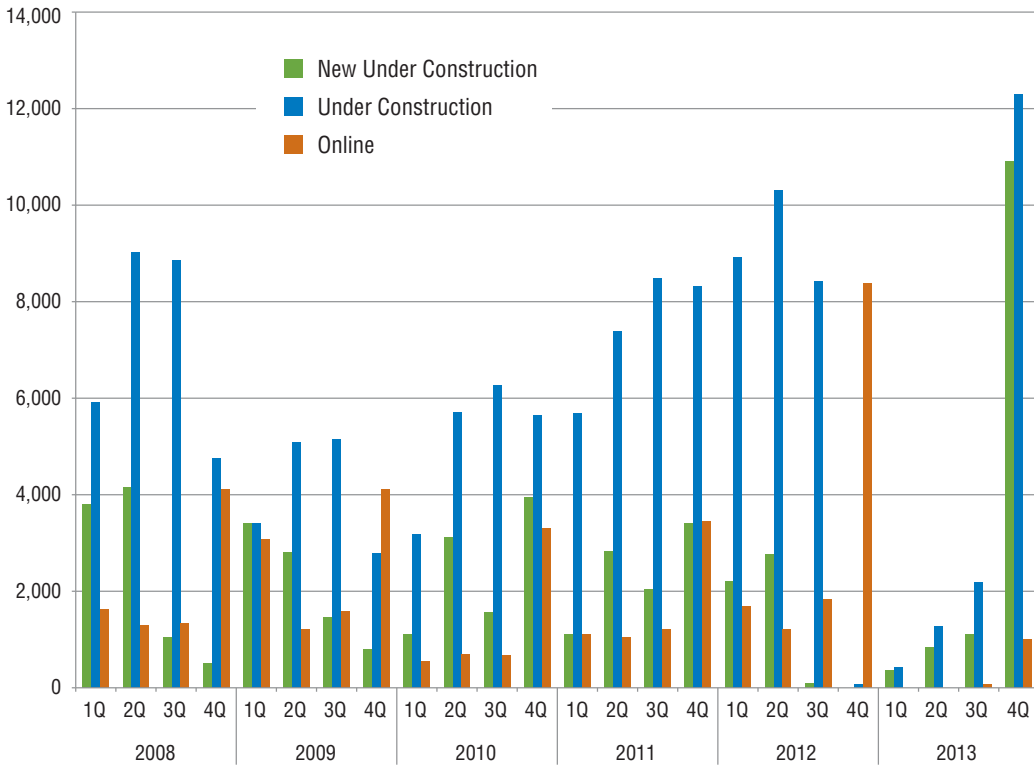
Following the late extension of the PTC and investment tax credit (ITC) on January 2, 2013, coupled with the rush to build projects in the fourth quarter of 2012 that spurred a historic number of installations, the U.S. wind industry installed 1.6 MW of new capacity during the first quarter of 2013 and 0 MW the second quarter. In the third quarter, the U.S. installed 68.3 MW through the completion of projects in Alaska, California, and Colorado.

The fourth quarter of 2013 saw the most activity with 1,012.4 MW completed across Kansas, California, Michigan, Texas, New York, Nebraska, Iowa, Colorado, Massachusetts, and Indiana.

Wind power capacity under construction, 4Q 2013



Completed and under construction wind power capacity, 2008–2013



Total wind power capacity installations for 2013 were 1,084 MW. This represents a 92% reduction from the record-setting 13,131 MW installed during 2012. This drop-off can be attributed to the late extension of the PTC and ITC in January 2013.

Despite the effects of the PTC's expiration, wind power's growth in 2013 was significant: there are now 61,108 MW of installed wind capacity in the U.S., enough to power over 15.3 million homes.

Of the projects under construction, at least 3,770 MW of wind energy projects have long-term power offtake agreements in place through long-term power purchase agreements (PPAs) or direct utility ownership. A large percentage of projects under construction in Texas are merchant capacity on ERCOT, the state's main grid operator, which as of this year is 10% wind-powered. Additional wind energy capacity has secured long-term power offtake agreements but has not yet started construction.

Construction in 2014 is focused primarily in the interior region, from North Dakota down through Texas. The late 2013 completion of the competitive renewable energy zone (CREZ) transmission lines in the Panhandle and Western parts of Texas has spurred wind

development in the state. According to ERCOT, 6,947 MW of proposed projects have signed interconnection agreements and a total of 24,000 MW of proposed wind projects have applied to connect to the ERCOT grid. The response to the opening of such high-quality wind resource has been so overwhelming that even though the CREZ grid upgrades were just completed, the grid operator is already exploring additional transmission expansions to facilitate more wind energy development in the Panhandle.

COST AND CONSUMER BENEFITS

Wind turbine prices and wind energy costs have dropped sharply in recent years. Technological improvements are rapidly making wind turbines more productive and reducing costs, while expanded U.S. manufacturing is achieving economies of scale and reducing transportation costs that can be up to a fifth of the cost of a wind farm. As mentioned, the DOE *Wind Technologies Market Report 2012* confirms that the cost of wind energy has declined by 43% over the last four years.

As the report explains:

1. The capital cost to develop wind power continues to drop
2. The average cost to purchase electricity provided by wind is falling
3. The productivity of wind turbines continues to increase
4. 70% of the value of wind turbines installed in the U.S. now carries a "Made-in-the-USA" label

Zero-fuel-cost wind energy directly displaces the output of the most expensive and least efficient power plants currently operating. Power plant rank order is based on the cost of producing an incremental amount of electricity, so only fuel costs and variable operations and maintenance costs are considered. As a result, wind energy and other zero-fuel-cost resources are always used first, and they displace the most expensive power plant that otherwise would have operated. Because that is almost always the least efficient fossil-fired power plant, adding wind energy significantly reduces fossil fuel energy costs, as well as pollution.

Significant water savings come along with those for fuel. In 2013, wind power saved 36.5 billion gallons of water. Not only does wind conserve water for other valuable uses, but it is a "drought-resistant cash crop," providing consistent income for farmers and ranchers who host turbines on their land.

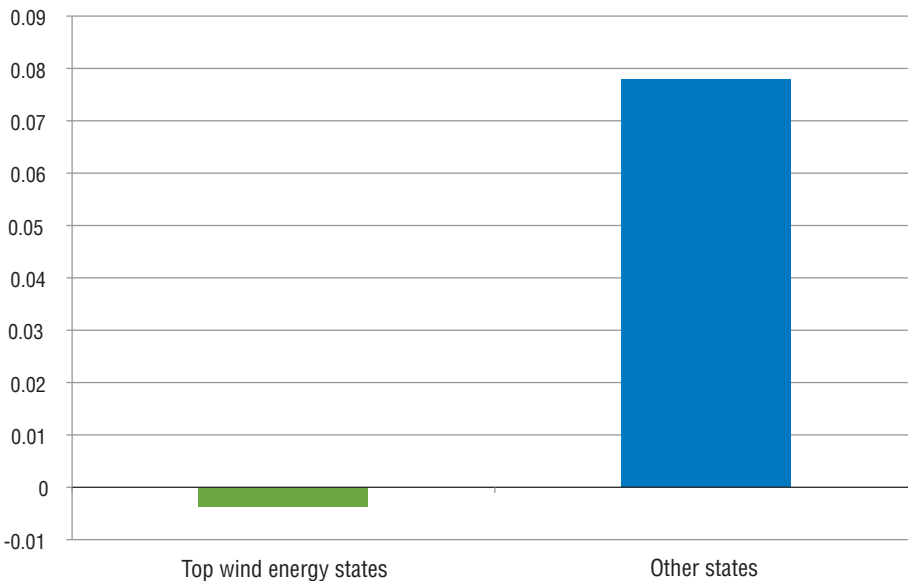
More than a dozen studies conducted by independent grid operators, state governments, academic experts, and others have found that wind energy benefits consumers by reducing electricity prices, and utilities are taking note:

“Wind prices are extremely competitive right now, offering lower costs than other possible resources, like natural gas plants.” David Sparby, President and CEO of Xcel Energy’s Northern States Power, announcing 600 MW of new wind power contracts in 2013.

“The expansion is planned to be built at no net cost to the company’s customers and will help stabilize electric rates over the long term by providing a rate reduction totaling \$10 million per year by 2017, commencing with a \$3.3 million reduction in 2015.” MidAmerican Energy Co., 2013 press release, after the Iowa Utilities Board approved the addition of 1,050 MW of wind generation in Iowa.

Cost savings with wind power are apparent across the country. Newly released DOE data shows that consumers in the states that use the most wind energy have fared far better than consumers in states that use less wind energy.

Electricity price changes, wind-heavy states versus least wind-heavy states



The 11 states that produce more than 7% of their electricity from wind energy have seen their electricity prices fall by 0.37% over the last five years, while all other states have seen their electricity prices increase by 7.79% over that period. This is clear evidence for wind energy’s impact on keeping consumers’ electricity prices down.

POLICY CERTAINTY AND OUTLOOK

To keep growing and providing clean, affordable electricity to ratepayers, the wind power industry must have a greater degree of policy certainty.

The PTC, as a performance-based incentive, has been a tremendous success.

With this credit in place, the U.S. wind industry was the number one source of new electricity generation capacity in 2012. In addition to bringing electricity to 15 million American homes, the PTC attracted \$25 billion of private investment in the U.S. economy in just one year — which is 17 times the current annual value of the tax credit. Without it, this level of private investment in the U.S. simply would not have occurred.

That investment means jobs in construction and manufacturing, federal, state, and local tax payments by the resulting wind farms and factories that more than repay the up-front tax relief, as well as lower electric rates.

Historically when the PTC has been allowed to expire, the U.S. industry has faced a 70-95% drop-off in installations; in 2013, that drop-off amounted to a 92% reduction in new wind generating capacity brought online.

A poll conducted by USA TODAY in December 2013 suggested Americans are reacting to the impacts of climate change and understand renewable energy's role in mitigating those effects. Of those surveyed, 73% supported continued tax incentives for wind, solar, and hydropower.

Policy stability is critical to continuing this story for American manufacturing and wind energy development. The industry needs the PTC extended for the longest practical term to provide our businesses the ability to plan and invest in further improvements in wind technology, investments which will continue to bring consumer costs down.

ABOUT THE AMERICAN WIND ENERGY ASSOCIATION

AWEA is the national trade association of the U.S. wind energy industry, with 1,300 member companies, including global leaders in wind power and energy development, wind turbine manufacturing, component and service suppliers, and the world's largest wind power trade show, the AWEA WINDPOWER Conference & Exhibition, which takes place next in Las Vegas, May 5-8, 2014. AWEA is the voice of wind energy in the U.S., promoting renewable energy to power a cleaner, stronger America.



The Outlook for **SOLAR ENERGY**

EXISTING MARKETPLACE

The U.S. solar industry has much to celebrate about the year 2013. Photovoltaic (PV) installations continued to proliferate, increasing 41% over 2012 to reach 4,751 MW_{dc}, and 410 MW_{ac} of concentrating solar power (CSP) plants also came online. Solar was the second-largest source of new electricity generating capacity in the U.S., exceeded only by natural gas. And the cost to install solar fell throughout the year, with average system prices ending the year 15% below the mark set at the end of 2012.

The U.S. solar market showed the first real glimpse of its path toward mainstream status in 2013. The combination of rapid customer adoption, grassroots support for solar, improved financing terms, and public market successes indicated clear gains for solar in the eyes of both the general population and the investment community. And in the long term, a mainstream solar industry will need customers who seek out and support solar, as well as investors who see an attractive risk-adjusted opportunity in the market.

The solar industry also became a major part of a much larger discussion that took center stage in 2013 around the future of electricity and electric utilities. As distributed solar gains steam, and as adjacent technologies such as energy storage become economically viable, the traditional utility business model is increasingly called into question. Throughout the electricity industry, 2013 was the year of catchphrases such as “utility 2.0” and “utility of the future.” Utilities themselves began to stake out positions on all sides of the issue, some seeking to protect their current territory and others investing in distributed generation—capitalizing on the opportunity that comes with change.

If 2013 was about raising the issue, 2014 will be about defining solutions. Increasingly, solar is not bound by its cost, but rather by its role in the electricity sector. And as solar continues



Rhone Resch

*President & CEO, Solar Energy
Industries Association*

(submitted courtesy of SEIA/GTM Research)

along its path toward the mainstream, its integration with the broader electricity market from a technical, market and regulatory perspective will become one of the most important issues in the industry.

Key Figures:

- The U.S. installed 4,751 MW of solar PV in 2013, up 41% over 2012 and nearly fifteen times the amount installed in 2008.
- There is now a total of 12.1 GW of PV and 918 MW of CSP operating in the U.S.
- More solar has been installed in the U.S. in the last eighteen months than in the 30 years prior.
- Solar accounted for 29% of all new electricity generation capacity in 2013, up from 10% in 2012. This made solar the second-largest source of new generating capacity behind natural gas.
- The wave of concentrating solar power installations slated for completion at the end of 2013 into 2014 kicked off with the 280 MW_{ac} Solana project and the Genesis Solar project's initial 125 MW_{ac} phase. In early 2014, BrightSource's notable Ivanpah project also began operating and SolarReserve's Crescent Dunes began commissioning.
- Each year approximately 30,000 solar water heating and cooling (SHC) systems are installed in the U.S., generating an estimated \$435 million in annual revenue. There is currently 9 GWth of SHC capacity installed in the U.S., and the country ranks 36th in the world in installed capacity relative to its population.

MARKET OUTLOOK

For 2014, our forecast calls for 26% overall growth in the U.S. solar market, with installations reaching nearly 6 GW. We expect growth in all three segments, though at varying magnitudes, with growth most rapid in the residential market.

Figure 2.14 U.S. PV Installation Forecast, 2010-2016

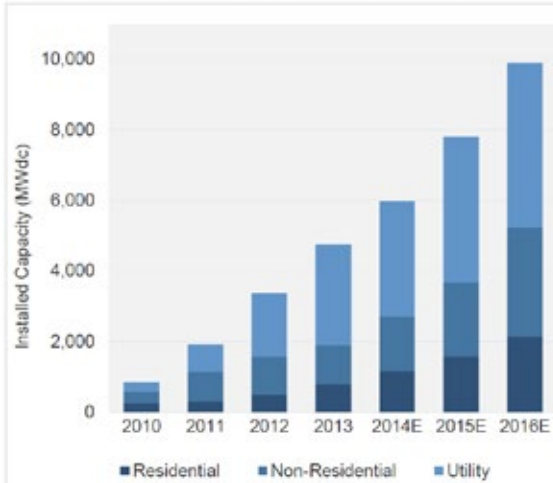
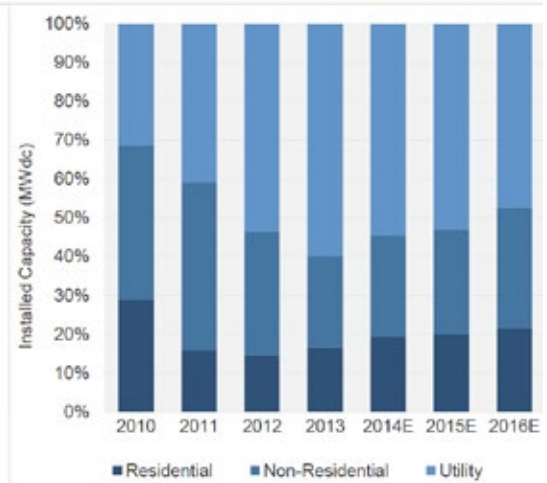


Figure 2.15 Installation Forecast by Segment, 2010-2016



Source: SEIA and GTM Research

Recent market developments that will have ramifications in 2014 and beyond include:

- Positive Early Signs in NEM Debates:** Disputes between utilities and solar advocates emerged over the issue of net energy metering (NEM) across a variety of markets, ranging from major solar states (e.g., California, Colorado and Arizona) to more nascent solar states (e.g., Utah, Idaho, Louisiana and Georgia). Broadly speaking, the solar market has remained unscathed thus far. But the next two years will bring both new venues for NEM debates and longer-term decisions in the existing battlegrounds.
- Financial Innovation:** After years of discussion and speculation, a number of new financing mechanisms for solar emerged in 2013. NRG Energy took its first YieldCo public, generating a tradable, dividend producing security that contains both utility-scale and rooftop solar projects, as well as fossil fuel assets. SolarCity successfully launched the first distributed solar securitization, worth \$54 million. Opportunities for consumers to invest in solar via crowdfunding or community solar gained new prominence.
- Cost Reduction:** PV module prices increased slightly in 2013, the first annual price increase since 2008. However, prices fell substantially for other components such as inverters (which decreased by 15% to 18%) and racking systems (19% to 24%). In addition, a range of other factors including downstream innovations drove down overall system prices throughout the year in all market segments. By the end of the year, system prices had fallen 9% in the residential market, 16% in the non-residential market and 14% in the utility market.

- **A New U.S.-China Trade Case:** On December 31, 2013, SolarWorld Industries filed a new antidumping/countervailing duty petition before the U.S. International Trade Commission. This petition seeks to prevent Chinese module manufacturers from using Taiwanese crystalline PV cells to avoid paying the import tariffs on modules with Chinese cells that were imposed after SolarWorld's initial petition, filed in October 2011. Under the previous ruling, Chinese module manufacturers can produce solar wafers in China, ship them to Taiwan for cell manufacturing, and then send them back to China for module assembly to avoid U.S. import tariffs of more than 30%. While the outcome of this case remains in question, it is likely to reshape the U.S. solar market in some fashion.
- **California Sees Unparalleled Growth:** California alone installed more than half of all solar in the U.S. in 2013. In fact, the state installed more solar in 2013 than the entire country did in 2011. California led the pack in each market segment and saw a doubling of installations in both the residential and utility segments. Looking to 2014, California shows no signs of slowing down, particularly in the distributed generation market.
- **The Ascent of North Carolina, Massachusetts and Georgia:** While Arizona and New Jersey, historically the second- and third-largest state solar markets, faltered in 2013, three states in particular emerged to fill the gap. North Carolina grew 171% over 2012 to install 335 MW, Massachusetts grew 76% to install 237 MW, and Georgia grew 762% to install 91 MW in 2013.
- **The Realized Promise of Centralized Solar:** The U.S. installed over 2.8 GW of utility solar in 2013, up 58% over 2012. Eleven individual projects of more than 50 MW each were completed in 2013, more than in any other year. Together, Arizona, California, and North Carolina accounted for 87% of all utility PV installations.

POLICIES NEEDED

Solar Investment Tax Credit

Since Congress raised the ITC to 30% in 2006, solar companies across all 50 states have responded by investing tens of billions of dollars, growing solar installations by 3,000%, employing nearly 143,000 American workers, all while driving down average system prices by 60%. The U.S. now has over 13,000 MW of installed solar electric capacity, enough to power more than 2 million American homes. The success of the ITC demonstrates the value of stable and predictable federal tax and energy policies for sustained private sector growth. In order for solar companies to be able to continue to make full and effective use of the ITC, SEIA is advocating that the current eligibility standard, which requires projects to be "placed-in-service" by the end of 2016, be changed so that projects instead must have "commenced construction" by the end of 2016. Bipartisan legislation to effect this change has been introduced in both the U.S. House and Senate.

Solar Water Heating and Cooling

Renewable heating and cooling standards would strongly complement existing renewable energy policies. The policies required to meet national targets should be long-term oriented and provide financial incentives. Long-term targets with clearly defined goals can take many forms—including renewable portfolio standards (RPS) with SHC eligibility, renewable thermal standards, and building mandates.

The three main types of financial incentives are tax credits, rebate/grant programs, and renewable energy credits (REC). Successful financial incentives allow businesses to make investments under predictable, long-term economic conditions.

Similar to the SunShot Initiative, the Federal government should also take a leadership role in reducing soft costs of SHC to achieve cost competitiveness with conventional fuels.

Other supporting programs include consumer awareness campaigns, research and development for innovation, demonstration projects, and workforce development.

Solar energy is widely supported in the U.S., with both Republicans and Democrats favoring solar above all other forms of energy. Sustained and smart investments in SHC will facilitate a unified transition to clean and low-cost heating and cooling solutions for the United States.

This article contains excerpts from the *U.S. Solar Market Insight Report: 2013 Year in Review*, produced by SEIA and GTM Research.

ABOUT THE SOLAR ENERGY INDUSTRIES ASSOCIATION

Celebrating its 40th anniversary in 2014, the Solar Energy Industries Association® is the national trade association of the U.S. solar energy industry. Through advocacy and education, SEIA® is building a strong solar industry to power America. As the voice of the industry, SEIA works with its 1,000 member companies to champion the use of clean, affordable solar in America by expanding markets, removing market barriers, strengthening the industry and educating the public on the benefits of solar energy. Visit SEIA online at www.seia.org. For more information, contact jbaca@seia.org (research) and cmansour@seia.org (federal affairs).



The Outlook for GEOTHERMAL ENERGY

EXISTING MARKETPLACE

In early 2014, the United States' installed geothermal power capacity is about 3,442 megawatts (MW). The Geothermal Energy Association (GEA) identified 182 projects under development as of September 2013, representing about 2,500 MW of planned capacity additions in the pipeline in 13 states. Image 1 shows total installed capacity in the U.S. over time since 1971. GEA will release new statistics in April, and while we expect a drop in total projects due to expiration of the production tax credit (PTC), inadequate transmission, and lackluster renewable portfolio standard (RPS) markets, we do not expect the drop to be as precipitous as witnessed in some other industries facing similar circumstances.



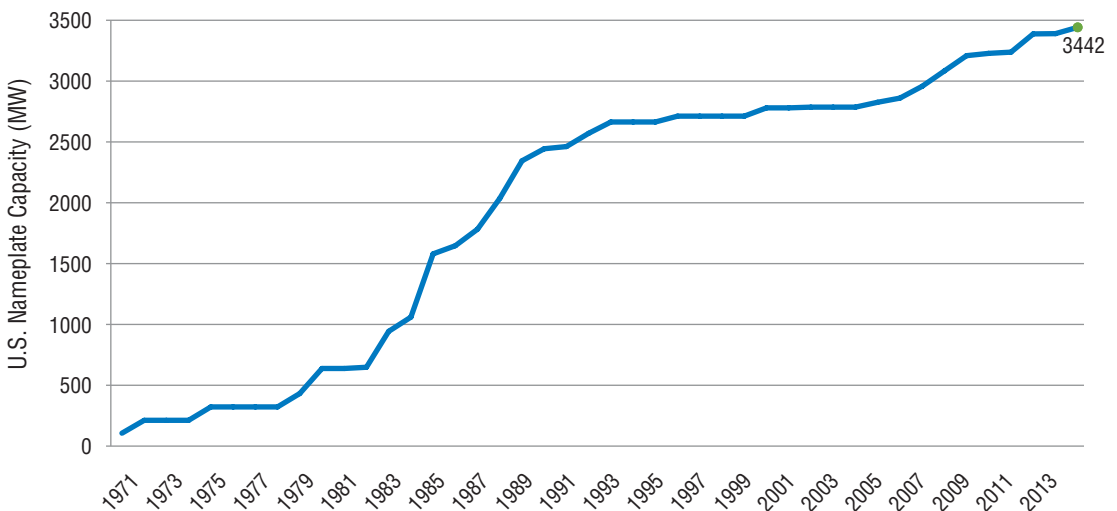
Karl Gawell

Executive Director, Geothermal Energy Association

Leslie Blodgett

Researcher and Editorial Services, Geothermal Energy Association

Image 1: Total Installed Geothermal Capacity in the U.S. Over Time

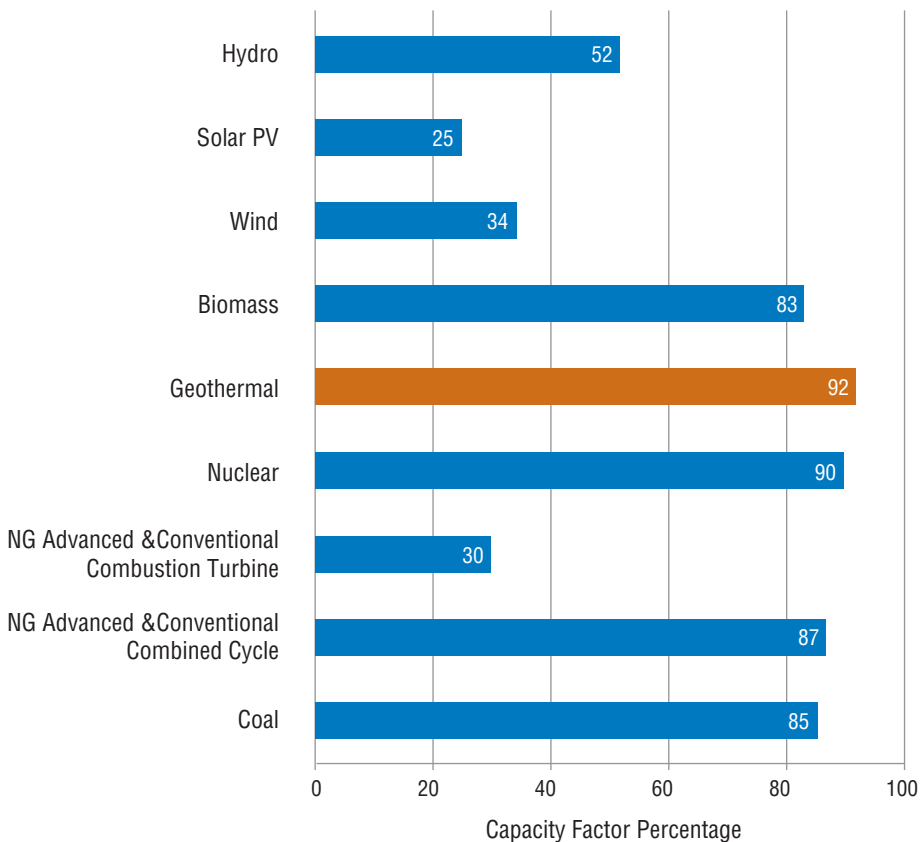


Source: GEA

Geothermal will continue to offer values that fulfill two major market drivers—state RPS requirements and federal environmental standards. It is a firm or flexible renewable power resource with predictable economics; upfront drilling costs represent the bulk of the risk, but once a geothermal plant is built, plants have among the lowest life cycle levelized costs of any energy source.

One reason why the geothermal model has had such a low levelized cost is that it has been traditionally used as a baseload resource, ensuring a steady revenue stream and stable prices with long plant lifetimes of 50 years or more. Thanks to this unique juxtaposition of benefits, geothermal can replace aging baseload coal or nuclear plants, or can be engineered to be flexible in order to firm up new intermittent resources such as wind or solar, depending on site-specific needs. Image 2 shows that geothermal power is one of the most efficient sources of electricity, with a capacity factor of 92%, meaning it almost fully uses the transmission capacity that it reserves and thus provides stability to transmission infrastructures.

Image 2: Average Capacity Factors for Plants Entering Service in 2018



Source: U.S. EIA and GEA

Geothermal power is locally produced and benefits communities through jobs and revenues to states and counties. The plants are usually located in rural areas that are most in need of the economic boost. A 2006 GEA estimate stated that for every dollar invested in geothermal energy, the resulting growth of output to the U.S. economy was \$2.50. Geothermal is also used directly for heat-intensive facilities such as greenhouses, aquaculture, and spas, as well as for district heating and ground source heat pumps.

MARKET OUTLOOK

In recent years, most geothermal plants that have come on line in the U.S. have been binary-cycle plants.

The 22-MW Neal Hot Springs, Oregon plant by U.S. Geothermal and TAS Energy came on line in 2013 and received that year's GEA Honors Technological Advancement Award for being the first commercial, supercritical organic rankine cycle binary power plant.

The industry's knowledge about enhanced geothermal systems (EGS) increased in 2013. Successful EGS projects in the U.S. were led by Calpine Corp., Ormat Technologies, and AltaRock Energy, and were all aided by the U.S. Department of Energy (DOE).

The DOE's Geothermal Technologies Office is focusing its research and development (R&D) efforts in EGS as well as in hydrothermal and resource confirmation, low-temperature resources, and systems analysis. Current funding opportunities are designed to support the industry's current needs and its most promising areas of growth.

Through a combination of industry entrepreneurship and public and private support, new technology developments are moving forward. A University of Minnesota startup began the first application of carbon dioxide plume geothermal, and a California company has started construction on the first commercial plant producing lithium carbonate from geothermal fluids.

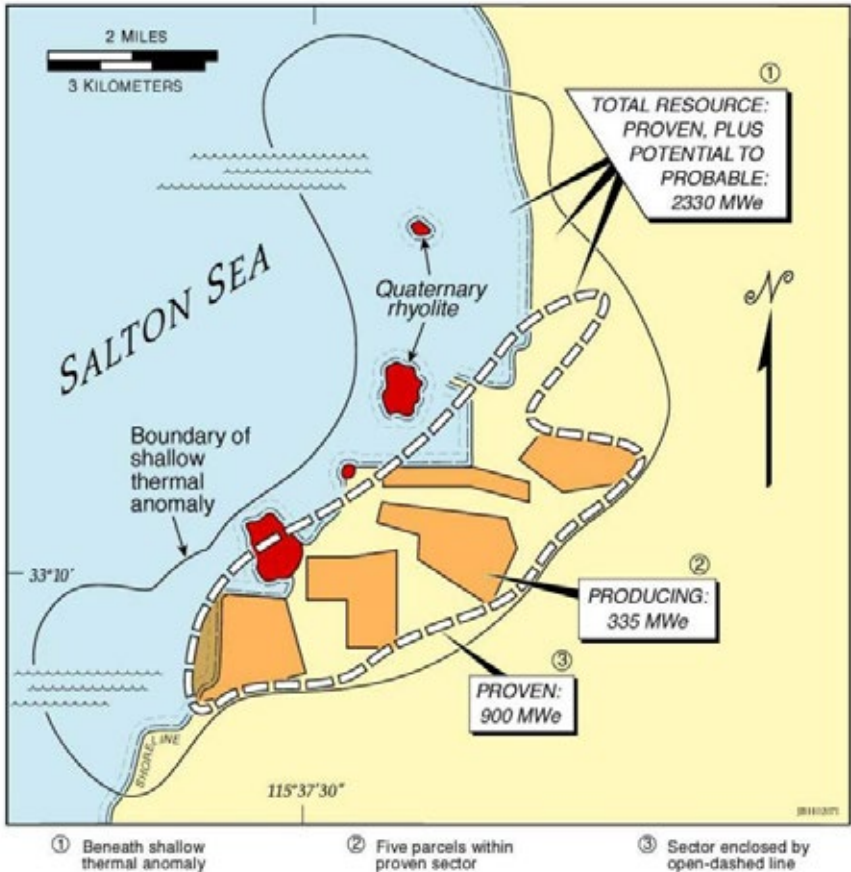
With New Mexico's first geo power plant coming on line at the beginning of 2014, there are now eight states with operating, large-scale plants: Alaska, California, Hawaii, Idaho, Nevada, New Mexico, Oregon, and Utah. U.S. geothermal development will likely continue in these states.



Stillwater Geothermal Plant in Nevada

In California, the Imperial Irrigation District announced in October 2013 that it would seek 1,700 MW of geo power as part of its Salton Sea restoration. The new renewable energy development is to go hand-in-hand with efforts to improve environmental quality as the Salton Sea changes. This is in an area that has been known for some time as a large geothermal resource that, with several geo power plants already in Imperial Valley, the industry has only begun to tap. Image 3 shows that there are about 2,330 MW of geo power reserves at the Salton Sea, enough to potentially power over 2 million homes.

Image 3: Geothermal Resources at Salton Sea, California



Source: Salton Sea Authority



In Nevada, Ormat Technologies and Gradient Resources both opened new geothermal plants in early 2014. Nevada leads the nation in geothermal projects under development, and the legislature passed a handful of laws in 2013 that create potential for several hundred new megawatts of geo power. Additionally, the One Nevada Transmission Line (ON Line) stretching from Las Vegas to Ely began service in January 2014, and it is expected to help tap geothermal resource in the north of the state to meet power needs in the south.

Another five states have geo power projects in early stages of development that will progress in the coming years: Arizona, Colorado, North Dakota, Texas, and Washington State. Each has unique obstacles to overcome regarding technology, resource risk, and/or state policy support. Recent technological developments have seen demos or hybrid applications in more places than ever before, including Mississippi and Minnesota.

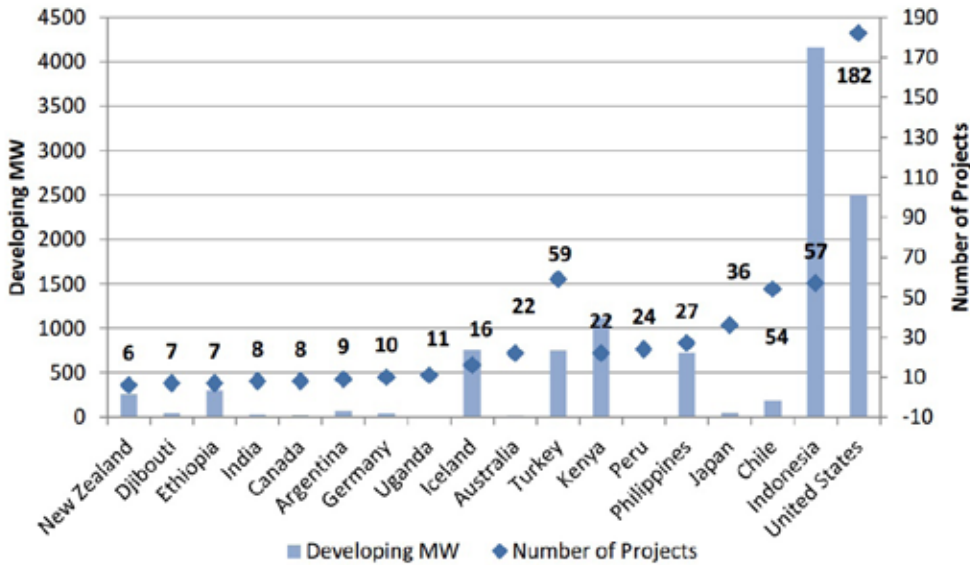
The policy choices that are made now will affect the success of the U.S. grid for decades to come. In the absence of a national renewable portfolio standard, state RPS goals are helping to drive geothermal and other renewable growth, and it is likely that state policies will continue to play a leading role.

Federally, 2013 was a fairly quiet year for geothermal law, but leadership exploded at the state level; at least 25 pieces of legislation were enacted in 13 states that relate directly to geothermal. These laws range from tax clarifications for ground source heating and cooling systems to public land use adjustments for high-temperature, electricity-generating power plants. An Oregon law made geothermal an eligible form of energy for net metering, which opens up a bright new opportunity for smaller scale projects to sell any extra power to the grid.

The federal role is not to be ruled out completely. A new clean energy tax proposal by Senate Finance Committee leaders breathes new life into efforts to establish long-term incentives for geothermal and other clean power technologies. The administration's efforts to limit carbon pollution should also support renewable energy development.

In September 2013, GEA identified 70 countries moving forward with nearly 700 geo power projects, compared to a similar report from 2007 that showed only 46 countries developing or actively considering geothermal projects. The international geo power industry is poised to place hundreds of megawatts on line every year for the rest of the decade. Image 4 shows the number of geothermal megawatts underway in countries that had six or more developing projects as of 2013.

Image 4: Top Countries with Geothermal Projects in Development, September 2013



Source: GEA

The U.S., with 182 developing projects as of September 2013, had nearly three times the number of its closest counterparts, Indonesia and the Philippines. However, many U.S. projects are progressing more slowly than projects in countries with less developed geothermal industries. Chile and Indonesia are just beginning to explore their large geothermal resources. Japan’s interest has grown quickly as it seeks to replace its nuclear plants after its Fukushima nuclear disaster. Today, roughly one-third of all the nations of the world are developing their geothermal resources, and the number of countries will continue to grow. We expect the global market to continue strong growth as climate policies and economic growth fuel demand for more geothermal power.

The U.S. is seen as the world’s geothermal industry leader, and U.S. companies are active in providing materials and experience abroad. Africa’s Rift Valley is an area of intense geothermal potential that has the benefit of support from the Obama administration’s \$7 billion Power Africa initiative. The U.S. government is supporting U.S. industry involvement in geothermal growth in Africa through the East Africa Geothermal Partnership between the U.S. industry (through GEA) and government (through USAID and the U.S. Energy Association (USEA)).

One difference in trends is the U.S. preference for binary-cycle technology for new power plants; in fact, since 2007, all but one of the new power plants that came on line in the U.S.

were binary. But many countries across Southeast Asia, South America, and Africa are just beginning to develop their higher-temperature resources and are building flash and dry steam plants, which the U.S. seemed to prefer a couple decades ago when it was likewise developing its “low-hanging fruit.”

As in the U.S., the international geothermal community sees a new frontier in EGS technology. In 2013, Australia put its first EGS pilot plant, a 1 MW trial, on line in Habanero. In Europe, there were EGS advancements in Hungary, the United Kingdom, and Switzerland. The U.S. DOE is moving forward to fund the development of a subsurface laboratory where new technologies and techniques can be tested.

RECOMMENDATIONS FOR GROWTH

The U.S. is the world leader in terms of geothermal development in the pipeline, but bringing those projects to fruition will not happen without continued effort from all parties, including industry, state, and federal leaders. It is likely that many U.S. companies will continue to set their sights on the burgeoning global geothermal market in order to stay competitive, while development moves a little more slowly at home. Many geo projects today face significant delays due to an uncertain policy environment and structural setbacks.

GEA President Craig Mataczynski of Gradient Resources has challenged the industry to envision a future where geothermal produces 5% of total U.S. electricity production. To accomplish this goal, the industry will need to work with federal and state governments to continuously improve technology, reduce regulatory delays, ensure incentives for investors, and fully recognize the value of geothermal power.

We expect that we will continue to see significant deployment of wind and solar power, and with this expansion, utilities will be seeking ways to support intermittent generation. Geothermal technology has the ability to provide flexible power to support wind and solar generation. We also expect that climate change will grow to become a serious national policy driver, and there will be higher value placed on replacing aging, baseload coal power plants. As a traditional baseload resource, geothermal will be a good fit.

A new report conducted by E3 in California illustrates the important role of geothermal energy in future policymaking. The report, “Investigating a Higher Renewables Portfolio Standard in California” was commissioned by five top utilities in California and evaluates the challenges, solutions, and consequences of increasing California’s RPS beyond 33% by 2030, as part of the state’s climate initiative. The study analyzes four alternative scenarios for achieving a 50% RPS by 2030, and findings show that the best alternative was the “Diverse Scenario,” which included the most geothermal generation and the greatest renewable power diversity.

At the national level, support for technology development and tax policy are the most pressing needs for the industry. DOE should bolster its Geothermal Technologies Office to support new technology that will be the key to future expansion and success. Efforts like the Senate Finance Committee's proposal for long-term incentives need to succeed to provide the financial atmosphere that will drive investment. Finally, with a majority of geothermal power on federal public lands, leasing and permitting efforts need to efficiently support new development.



PHOTO: SAM ABRAHAM

Puna Geothermal Venture in Hawaii



ABOUT THE GEOTHERMAL ENERGY ASSOCIATION

The Geothermal Energy Association (GEA) is a trade association comprised of U.S. companies that support the expanded use of geothermal energy and are developing geothermal resources worldwide for electrical power generation and direct-heat uses. GEA advocates for public policies that will promote the development and utilization of geothermal resources, provides a forum for the industry to discuss issues and problems, encourages research and development to improve geothermal technologies, presents industry views to governmental organizations, provides assistance for the export of geothermal goods and services, compiles statistical data about the geothermal industry, and conducts education and outreach projects. For more information, please visit www.geo-energy.org. Subscribe to GEA's newsletter [here](#). Follow GEA on [Twitter](#). Become a fan on [Facebook](#). For more information, please contact leslie@geo-energy.org.





The Outlook for **HYDROPOWER**

EXISTING MARKETPLACE

Hydropower is the largest source of renewable electricity in the United States, responsible for over half of all renewable electricity generation last year and 7% of total generation. In fact, the largest power producing facility in the U.S. is the Grand Coulee Dam in Washington State, with an installed capacity of over 6,800 megawatts (MW).

Using hydropower provides enough clean power for 30 million typical American homes and annually helps avoid nearly 200 million metric tons of carbon emissions. The 100,000 MW of total hydropower capacity also includes approximately 20,000 MW of pumped storage hydropower, which presently provides 98% of all energy storage in the United States.

Hydropower is unique among energy resources due to its ownership. The federal government owns just over half of the hydropower capacity in the United States. The other half is held by non-federal entities that receive licenses from the Federal Energy Regulatory Commission (FERC). These entities include investor-owned utilities, public utilities, and independent power producers.

Hydropower is also a powerhouse of economic development. For over a century, hydropower has provided clean energy that powered our way out of the Great Depression and fueled the war effort in the Second World War. Today, the industry employs between 200,000-300,000 American workers and supports a vibrant supply chain of over 2,500 companies that reaches from coast to coast. Navigant Consulting found in 2010 that with the right policies in place, the industry could support an additional 1.4 million cumulative jobs by 2025 while expanding hydropower capacity by 60,000 MW.

Recent years have seen an uptick in development, mostly following the inclusion of hydropower in the renewable energy production tax credit in 2005 and the passage of the American Recovery and Reinvestment Act of 2009.

Such programs have been extremely successful. To date, 128 projects have qualified for the production tax credit, each seeing nearly a 10% increase in generation. Last year,



Linda Church Ciocci
*Executive Director, National
Hydropower Association*

PPL completed a 125 MW expansion of its 108 MW Holtwood hydropower facility on the Susquehanna River in Pennsylvania. This expansion qualified for the 1603 Treasury grant program. Build America Bonds were used to finance American Municipal Power's hydroelectric projects, currently under construction along the Ohio River, which will add over 300 MW of hydropower capacity to four non-powered Army Corps of Engineers dams.

MARKET OUTLOOK

The hydropower industry will see significant activity over the next five years, though a lack of policy certainty from Washington will put a damper on this trend unless action is taken.

Over the next five years, 6,000 MW of non-federal hydropower licensed by the FERC will be up for re-licensing. When looking forward to the next 10 years of re-licensing activity, that number more than doubles.

Many new projects will begin construction or be brought online in the same timeframe. Since 2009, developers have received licenses and exemptions from the FERC for 609 MW of new hydropower capacity. Those megawatts will join the 931 MW of capacity that has been placed in service since 2009.

But an even larger backlog of projects exists at FERC. Currently, there are nearly 65,000 MW of proposed hydropower projects in the FERC pipeline at various stages of the regulatory process. While many of these projects will not be built, the number suggests that strong developer interest and large untapped potential still exist in the United States.

However, many of these projects risk being shelved due to the lack of policy certainty. Expiration of the production tax credit at the end of last year will continue to be felt throughout the industry. Although it was extended for one year at the end of 2012, one-year extensions do little to incentivize developers who are looking at a more than five-year regulatory process for licensing a hydropower project. Exacerbating this situation is the fact that hydropower developers qualify for less than half the credit that other renewable energy technologies receive.

Some of these projects may find regulatory relief, thanks to policymakers reaching the only point of consensus on energy policy since 2009. Last August, President Barack Obama signed two hydropower bills into law: the Hydropower Regulatory Efficiency Act of 2013 (P.L. 113-23) and the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act (P.L. 113-24). Passed by Congress with overwhelming bipartisan support, these two bills aim to streamline the regulatory process for certain types of hydropower projects in the United States, including new small and conduit projects, closed-looped pumped storage projects, and adding power to the nation's non-powered dams.



These bills have the potential to remove the regulatory burden for many low impact projects. Since their enactment in August, 16 small conduit projects totaling 8 MW of capacity have been determined not to require FERC approval, thus removing a significant financial and regulatory burden for these small developers.

FERC is also now in the implementation stage of investigating a two-year licensing process for non-powered dams and closed-looped pumped storage. Currently only 3% of the nation's 80,000 dams are utilized for electric power production. The U.S. Department of Energy (DOE) completed a study in 2012 which found that more than 12,000 MW of capacity could be added at the nation's non-powered dam infrastructure. Two-thirds of that capacity could be developed at just the top 100 dams.

Additionally, the federal government is reinvesting in its aging infrastructure. In February 2014, the Army Corps of Engineers announced that it would invest \$1 billion over 20 years to renovate its aging hydroelectric generators across the Southeast region.

POLICY RECOMMENDATIONS

Stable, predictable policies supporting the growth and development of hydropower are necessary now more than ever.

NHA urges Congress to expeditiously enact tax policy that incentives deployment, provides certainty, treats all sectors fairly, and provides flexibility to developers. Continued one-year extensions of the production tax credit provided at the current rate offer no long term certainty to developers assessing the feasibility of their planned projects. A permanent or long-term extension must also provide parity of rate to all qualifying technologies.

Congress should also build on the momentum started with the unanimous passage of the Hydropower Regulatory Efficiency Act of 2013 and find additional regulatory improvements to expedite the licensing of hydropower projects. Though the bills enacted last year are a great first step, additional work is necessary even as those bills are being implemented. NHA remains committed to working with Congress and the various stakeholders of the hydro licensing process to find common ground and common sense changes.

Finally, continued investment in research and development in conventional and emerging hydropower technologies is critical to the continued growth of the industry. Gains made over the past decade in developing more environmentally friendly turbines and bringing new technologies to market will be in vain if the Water Power Program at the DOE is zeroed out again as it was under the previous administration.

ABOUT THE NATIONAL HYDROPOWER ASSOCIATION

The National Hydropower Association (NHA) is a nonprofit national association dedicated to promoting the growth of clean, affordable U.S. hydropower. It seeks to secure hydropower's place as a climate-friendly, renewable and reliable energy source that serves national environmental, energy, and economic policy objectives.

NHA unites the diverse North American hydropower community, providing a powerful advocacy voice among U.S. decision makers, the general public, and the international community. Through membership, individuals and organizations gain access to regulatory bodies, influence over energy and environmental policy, and a means to exchange valuable information within the industry.

NHA represents nearly 200 companies in the North American hydropower industry, from Fortune 500 corporations to family-owned small businesses. Our members include both public and investor-owned utilities, independent power producers, developers, manufacturers, environmental and engineering consultants, attorneys, and public policy, outreach, and education professionals.

For more information, please contact: linda@hydro.org.





The Outlook for

MARINE AND HYDROKINETIC ENERGY

MARKET OVERVIEW

The marine and hydrokinetic (MHK) renewable energy sector is an emerging industry with an ever-changing outlook, and significant challenges and advantages coming from existing industries, international competition and cooperation, and competition for limited resources.

The examples of cooperation have in many ways created models of inspiration, as competitors acknowledge that no country has substantial market share at this time, and that all boats rise with the tide.

Some areas of international collaboration include U.S. participation in the International Energy Agency's (IEA) Ocean Energy Systems (OES) initiative, which brings together 19 countries and the International Electrotechnical Commission's (IEC) Technical Committee 114 (TC-114) for marine energy, with 14 participating countries and nine observing countries.

OES collaborates internationally to accelerate the viability, uptake, and acceptance of ocean energy systems in an environmentally acceptable way, while TC-114 is developing industry standards which, in many respects, will lead to technical certifications required for financing and insurance purposes. The U.S. MHK sector's involvement with IEC and OES is not unique, and TC-114 regularly coordinates with other technical committees, such as the IEC's Technical Committee 88 (TC-88) for wind power. Due to experience and recommendations from the U.S. Department of Energy (DOE) and its National Renewable Energy Laboratory (NREL), the U.S. MHK sector was able to engage early with the OES and IEC. Today, the IEC Chair and Vice Chair of the OES are both Americans.

OES was founded by three countries in 2001 and has since grown to 19 countries. Looking forward, the 2012 OES Annual Report forecasts the growth of the worldwide market for MHK: "By 2030 ocean energy will have created 160,000 direct jobs and saved 5.2 billion tonnes of CO2 emissions."



Sean O'Neill

*President, Ocean Renewable
Energy Coalition*

The United States MHK roadmap, developed by the Ocean Renewable Energy Coalition in 2011, forecasts the growth of the U.S. market: “The MHK industry has significant potential for job creation in the manufacturing and marine services sectors. We estimate that our goal of 15 GW installed capacity by 2030 would support the creation of nearly 36,000 direct and indirect jobs across the country for fabrication, installation, operations and maintenance of MHK devices.”

The first grid-connected offshore tidal generation unit in the U.S. was completed in 2012, built by the Ocean Renewable Power Company (ORPC) in Eastport and Lubec, Maine. ORPC will expand from this unit to increase the Maine Tidal Energy Project's output to up to 5 MW.

In Scotland, installed capacity was 10 megawatts (MW) in January 2013. As of January 2013, there were 41 wave and tidal projects under development or operation in U.K. waters on the Crown Estate, with a total potential installed capacity of over 2 GW. The projects are of four main types:

1. Managed test and demonstration facilities, which provide infrastructure and/or services for several single prototypes and small arrays of devices;
2. Test projects up to 3 MW, which typically involve a single prototype technology;
3. Test and demonstration projects between 3 MW and 50 MW, which are generally for arrays of devices; and
4. Commercial array projects of 50 MW or greater capacity.

The first open water test center in the world is the European Marine Energy Center (EMEC) in the Orkney Islands of Scotland, which has been in operation for ten years. In a program entitled MARINET, the European Union provided access to 47 test facilities throughout Europe to technology developers at no cost.

In the United States, the U.S. Navy tested Ocean Power Technologies' PowerBuoy for several years prior to the establishment of three U.S. Department of Energy Test Centers in 2008, including facilities at Florida Atlantic University, University of Hawaii, and a collaborative open water test facility in Oregon called the Northwest National Marine Renewable Energy Center (NNMREC). NNMREC is a partnership between Oregon State University (OSU) and the University of Washington (UW). While OSU focuses on wave energy, UW's emphasis is tidal energy. These test facilities are charged with facilitating the development of marine renewable energy technology via research, education, and outreach. As an example of international cooperation, the first wave buoy tested in the U.S., by NNMREC, was developed in New Zealand by Power Projects, Limited.

Boston-based Resolute Marine Energy is presently developing a wave energy park for Yakutat Power in Yakutat, Alaska. With existing electricity prices in Alaska ranging from

\$0.40-\$1.00/kWh, Alaska represents an excellent distributed generation market with its rural microgrids and high existing prices. As an example of cooperation among U.S. companies, Resolute Marine energy is working with Ocean Renewable Power Company on Resolute's Yakutat project, as both companies investigate potential in the Alaskan market. In some respects, the Alaskan market represents an excellent model for export potential, particularly in emerging countries with distributed generation needs.

With more than 100 technologies under development worldwide, the most widespread categories of wave and tidal energy converters fall into the areas ranging from the basic to the exotic.

WAVE ENERGY CONVERTERS	TIDAL ENERGY CONVERTORS
Point Absorbers	Helical Turbines
Wave Overtopping Reservoirs	Horizontal-Axis Turbines
Attenuators	Underwater Kites
Oscillating Water Columns	Polymer-Based Generator
Inverted Pendulums	Vortex Induced Vibration
Reverse Magnetostriction	

The ocean's constantly changing dynamics and varied geography present challenges in terms of technology convergence. Where wind technologies generally converged into the three bladed horizontal turbine—a technology that also works in tidal areas – the various MHK technologies are finding specific efficiencies and strengths driven by the location and characteristics of the subsea terrain and varying dynamics of the water.

Ultimately, with the majority of populations throughout the world living near the oceans, it makes sense to generate power near the load without competing for precious land resources or requiring thousands of miles of transmission lines.

The greatest wave resource in the U.S. is on the West Coast. The best tidal resources tend to be farthest from the equator, and ocean currents like the Gulf Stream represent a baseload resource. The technically available tidal and wave resource is estimated to be 1,400 kWh per year.

The operating experience is beginning to grow for the MHK industry throughout the world, and the U.S. has an opportunity to compete; however, it will require consistent support from the federal government.

U.S. Department of Energy Secretary Moniz commented to Members of Congress in 2013 that he was looking to increase DOE-funding support for what he called the “forgotten renewables,” including marine hydrokinetic renewable energy.¹

In contrast, the U.K. wave and tidal energy market alone is estimated to be worth over \$1 billion USD by 2035.²

On March 3, 2014, DOE released its Fiscal Year 2015³ budget submission, which proposes to increase the Energy and Efficiency and Renewable Energy (EERE) budget by over 20%, but would cut MHK research and development (R&D) by 25%.

We need Congressional support for R&D to improve this innovative energy technology.⁴ Just as the wind and solar industries have received significant DOE funding for over twenty years (which has resulted in cost competitiveness and the rapid deployment of these technologies in recent years), the nascent MHK energy industry is requesting similar federal assistance to develop promising technologies that are on the verge of commercial viability. MHK deserves to be part of DOE’s “all the above” energy strategy.

POLICY RECOMMENDATIONS

- Stable and consistent funding for the DOE Water Power program in FY15, providing at least \$50 million for MHK technology R&D
- Department of Defense (DoD) support for technology development and testing, as demonstrated at the Hawaii wave energy test site
- DOE-sponsored national MHK deployment timeline and technology roadmap, to help compete with the E.U.
- Accelerated decision-making for efficiently siting and permitting MHK devices
- Investment incentives for new MHK technologies (production tax credit, investment tax credit, five-year MACRS depreciation)
- Continued support of DOE-authorized Marine and Hydrokinetic Technology test centers

1 See his testimonies before the House Energy and Commerce Committee, <http://energycommerce.house.gov/hearing/obama-administrations-climate-change-policies-and-activities> and the House Science, Space and Technology Committee <http://science.house.gov/hearing/full-committee-hearing-department-energy-science-technology-priorities>

2 <http://renews.biz/61464/uk-marine-worth-800m-by-2035/>

3 http://energy.gov/sites/prod/files/2014/03/f8/eere_fy15_budget_breakout.pdf

4 <http://www.lehigh.edu/engineering/news/events/ine/pdf/Reed.pdf>

ABOUT THE OCEAN RENEWABLE ENERGY COALITION

The Ocean Renewable Energy Coalition (OREC) is the only national trade association exclusively dedicated to promoting marine and hydrokinetic renewable energy technologies from clean, renewable ocean resources. Founded in April of 2005, the Coalition brings together technology developers, consultants, law firms, investor-owned utilities, publicly owned utilities, universities, and scientific and engineering firms. The coalition is working with industry leaders, academic scholars, and other interested NGO's to encourage ocean renewable technologies and raise awareness of their vast potential to help secure an affordable, reliable, environmentally friendly energy future. OREC seeks a legislative and regulatory regime in the U.S. that fosters the growth of ocean renewable technologies, their commercial development, and support in the race to capture the rich energy potential of our oceans.





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The Outlook for **BIOMASS ENERGY**

Biomass Power

EXISTING MARKETPLACE

The biomass power sector has undergone significant growth in recent years. The 2013 completion of several large-scale projects added up to more than 750 megawatts (MW)—enough to power hundreds of thousands of homes and businesses. All regions of the country have experienced some biomass growth, but the Southeast has experienced the most, with major new facilities opening in Gainesville and Brooksville, Florida; Altavista, South Boston, Hopewell, and Southhampton, Virginia; Dorchester and Allendale, South Carolina; and Barnesville, Georgia. Much of the growth can be directly attributed to federal incentive programs, which have since expired. The Treasury Department's 1603 Grant program, established in 2009, helped to make several of these facilities a reality by securing loans needed to attract serious investors.



Bob Cleaves
President, Biomass Power Association

FIVE-YEAR OUTLOOK FOR THE BIOMASS INDUSTRY

Opportunities for further development, while difficult to predict, are significant.

The country has not nearly maximized the potential for using existing wood and agricultural residues to create energy. The Biomass Power Association believes existing materials provide an opportunity for the industry to double its existing capacity. Simply taking full advantage of the forest management residue available in heavily forested areas like the Southeast, Pacific Northwest, and Northeast would go far toward realizing the full potential for biomass.

The U.S. Department of Agriculture (USDA) is making strides to ensure that biomass becomes a critical component of forest management and wildfire prevention. Programs like its Biomass Crop Assistance Program provide funding for the collection, harvest, transport, and storage of the forest debris that can contribute to forest fires. USDA also administers a

grant program that creates public-private partnerships between U.S. Forest Service offices and local biomass facilities.

Such programs will help deploy biomass in areas with abundant local fuel sources. However, more must be done on the federal level to ensure that existing biomass facilities remain financially secure, and that more facilities can be built where feasible.

POLICY RECOMMENDATIONS

Key policy changes will help encourage the growth and stability of the bioenergy industry:

- **Recognize the carbon benefits of bioenergy:** The U.S. Environmental Protection Agency (EPA) is considering a proposed rule that will address emissions from biomass facilities. It is important that EPA embrace the science and recognize that, because biomass carbon is part of a closed-loop cycle, it has low or no net carbon emissions and should not be regulated in the same manner that the Administration is proposing for coal plants.
- **Energy tax reform should promote all renewable technologies equally:** It is not enough to simply extend the current production tax credits. Changes to energy tax policy should be made to (1) maximize deployment; (2) encourage project stability that will help secure private investment; (3) take into account the development challenges that are unique to development for each renewable energy technology; (4) assume the viability of existing biomass plants; and (5) be customized for optimal advantage by the diverse energy facility and owner types.
- **Federal and state energy policy and renewable targets should recognize biomass as the valuable renewable resource that it is:** Biomass, as a reliable baseload energy source, which contributes to a reduced risk of catastrophic forest fires, should be an essential element of every renewable energy portfolio. Science demonstrates that properly deployed biomass power promotes carbon stocks and the managed forest industry, which can serve a central role in reducing carbon dioxide emissions.

ABOUT BIOMASS POWER ASSOCIATION

Biomass Power Association represents the American biomass power sector. Our members use sustainably-sourced organic materials, such as residues and byproducts left over from forest harvests and farming, to create electricity and heat in 22 states. Biomass energy converts these low value materials to power and heat—enough for nearly 1 million homes and businesses, adding almost \$1 billion to the nation's economy, and sustaining rural economies by preserving working forests and farms. For questions, please contact Carrie Annand, VP, External Affairs at carrie@usabiomass.org.

Biomass Thermal Energy



EXISTING MARKETPLACE

Thermal energy represents more than 30% of all energy consumption in the U.S. The market for biomass thermal energy, generated from combusting organic matter for heating or cooling purposes, has seen continuing growth in regions of the United States where there are: (1) high fossil fuel costs; (2) reliable access to renewable biomass feedstocks; and (3) year-round or prolonged heat energy demand.

Successful biomass thermal installations meeting these conditions are typically located in the Northwest, Midwest, Mountain West, Northeast, and Mid-Atlantic. Approximately 10 million American households, 300 colleges and government buildings, and 500 combined heat and power facilities used biomass (e.g. wood and agricultural residues) for part or all of their thermal energy needs in 2013. The Environmental Protection Agency (EPA) estimates at least 10,000 commercial and industrial biomass boilers nationwide.

Biomass fuel production is difficult to quantify because biomass thermal fuels are primarily by-products of forest and agricultural processes. Roughly 2.5 million metric tons of wood pellets were produced for domestic consumption in 2012. Additionally, pellets produced in the U.S. for export to foreign markets, mainly to Europe for meeting renewable energy mandates, amounted to 1.5 million metric tons, bringing national production of wood pellets to 4 million metric tons in 2012.

At the beginning of 2014, 145 U.S. pellet mills were either operational, under construction, or proposed, representing 14.5 million metric tons of production capacity. However, much of this expansion is attributed to a few high-output pellet mills in the Southeast, each capable of producing more than one million tons per year. In addition to pellets, non-pelletized agricultural residue, wood chips, and cord wood represent a significant percentage of biomass thermal energy production, though quantifiable production data for these domestic renewable fuels is unavailable.

Joe Seymour

Executive Director, Biomass Thermal Energy Council

Emanuel Wagner

Programs Director, Biomass Thermal Energy Council

Dennis R. Becker, Ph.D.

Associate Professor Forest Resources & ESPM, University of Minnesota

Charlie Niebling, Principal, Innovative

Natural Resource Solutions, LLC

OUTLOOK

The industry's growth over the next five years will hinge on the price volatility of competing fossil fuels such as propane, heating oil, and natural gas. The residential biomass heating market grew by 34% from 2000 to 2010 with a cost advantage of 25–50% over propane and heating oil, and propane price spikes, like in the winter of 2014, tend to exacerbate this gap. High-efficiency and low-maintenance automated biomass heating systems in rural Oregon and New Hampshire illustrate heating cost savings of up to 40%. Promising breakthroughs in the bulk distribution of biomass fuels and development of regional biomass heating clusters will increase consumer confidence in residential and commercial installations. Oil dependent markets like Massachusetts anticipate 20% residential and commercial growth through 2020; additional clusters are likely to develop in New York, Vermont, Maine, and Minnesota.

POLICY AND REGULATORY DEVELOPMENTS

There is vast untapped potential for renewable thermal energy in the U.S. Despite limited state and federal support, the biomass thermal market has been and will continue to grow.

Important developments in policy include federal regulations for air emissions, the establishment of fuel quality standards paired with appropriate technology, new tax or other incentive programs recognizing high efficiency systems, and thermal inclusion in energy mandates.

In terms of emissions from biomass appliances, the EPA's pending rules for the permitting of facilities that release CO₂ from renewable biomass could either advance or significantly hinder commercial and industrial applications. State authorities also continue to update air quality regulations, which will lead to a wider adoption of more efficient combustion technologies. However, uncertainty about the direction of these regulations is hindering near-term installations.

The Pellet Fuels Institute (PFI) has developed a domestic quality standard for pellet fuels in parallel with pending federal wood heating regulations, pairing certified heating appliances with a uniform fuel to reduce air emissions. Similarly, the Biomass Thermal Energy Council (BTEC) has initiated development of an efficiency standard for commercial solid biomass-fueled boilers to differentiate high from poor performers and thus improve adoption by building professionals. Legislators have considered adopting such an efficiency standard as a condition of tax credits for high efficiency heating systems.

The Biomass Thermal Utilization Act (S. 1007, or BTU Act) would create tax parity for high efficiency biomass thermal systems akin to commercial and residential solar thermal and geothermal technologies, helping overcome high upfront consumer capital costs. The

passage of the 2014 Farm Bill included mandatory funding for biomass thermal eligible programs, such as the Biomass Crop Assistance Program, Rural Energy for America Program, and Advanced Biofuels Producer Payment Program. Farm Bill programs have historically had little impact on biomass thermal installations compared to market drivers like rising fossil fuel costs, but provide an important market signal.

Inclusion of renewable thermal energy sources in federal and state building energy mandates would cost-effectively address requirements to reduce fossil fuel usage for space heating and cooling and demonstrate the government “leading by example.” Unfortunately, EPACT 2005—the guiding federal law—only authorizes renewably sourced electricity. Inclusion of renewable thermal could also easily extend to Department of Energy efficiency programs, where fuel switching from fossil to biomass fuels is effectively penalized.

Policy efforts on the federal front would also accelerate market adoption and the associated economic and environmental benefits. Legislation and regulatory action that recognize biomass thermal fuels and technologies as part of tax, energy, or climate policy would replicate the growth seen by comparable renewable thermal and electric technologies.

ABOUT THE BIOMASS THERMAL ENERGY COUNCIL

The Biomass Thermal Energy Council (BTEC) is an association of biomass fuel producers, appliance manufacturers and distributors, supply chain companies and non-profit organizations that view biomass thermal energy as a renewable, responsible, clean and energy-efficient pathway to meeting America's energy needs. BTEC engages in research, education, and public advocacy for the fast growing biomass thermal energy industry. For more information, visit www.biomassthermal.org. For questions about BTEC or the biomass thermal energy market in the U.S., contact Joseph Seymour, joseph.seymour@biomassthermal.org.



The Outlook for WASTE-TO-ENERGY

EXISTING MARKETPLACE

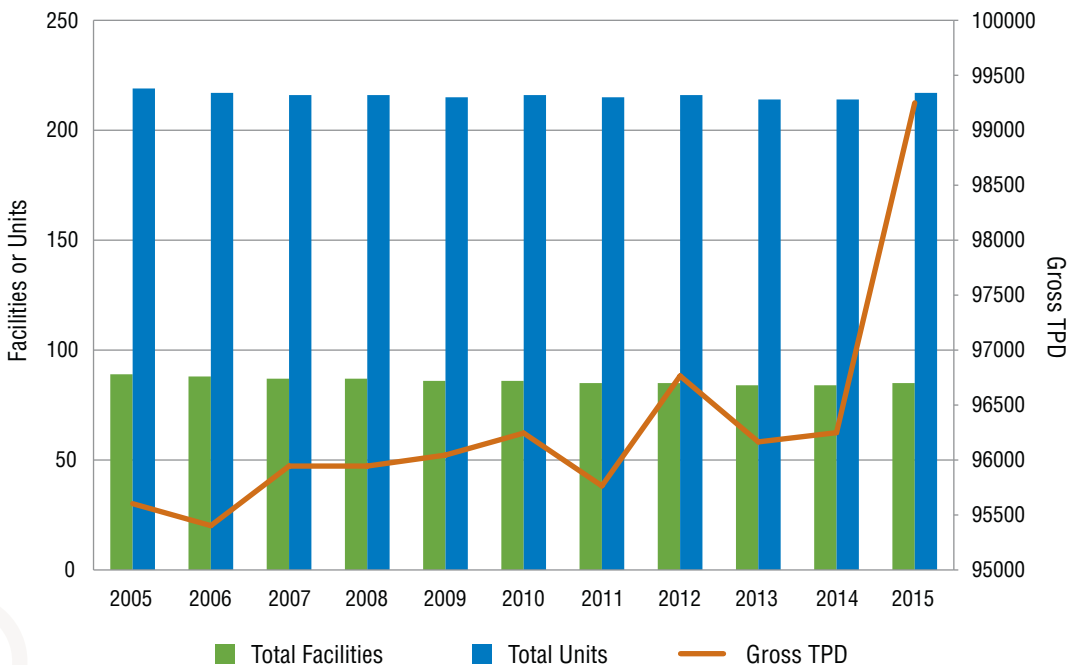
Waste-to-energy (WTE) is a proven technology used globally to generate clean, renewable energy from the sustainable management of municipal solid waste (MSW). Progressive communities around the world employ strategies to reduce, reuse, recycle, and recover energy from waste. Post-recycled MSW is an abundant, valuable, and underutilized source of domestic energy.

By processing this material, WTE facilities: produce renewable, base-load energy; reduce greenhouse gases; create good-paying, green jobs; operate with superior environmental performance; and complement recycling goals.



Ted Michaels
President, Energy Recovery Council

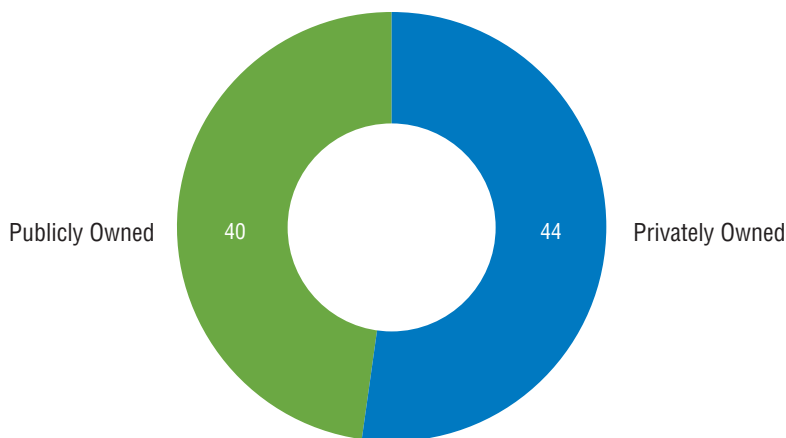
WTE Capacity



There are 84 WTE facilities (40 of which are owned by local governments) in 23 states, which have the capacity to process more than 96,000 tons of waste per day and have an electric capacity of more than 2,775 MWh. Due to high operational availability, the nation's WTE facilities process in excess of 30 million tons of trash per year, sell more than 14.5 million megawatt hours to the grid, and recover and recycle more than 730,000 tons of ferrous metals. In addition, approximately one-quarter of all WTE facilities in the U.S. sell steam directly to end users offsetting the use of fossil fuels to make that energy.

The revenues, employment, and labor earnings derived from managing waste, producing energy, and recycling metals are the direct economic benefits of waste-to-energy. In addition, these activities generate indirect impacts as well as induced impacts. Total sales revenues at the 84 WTE facilities in 2011 was \$3.2 billion. The total national economic impact of these revenues is \$5.6 billion. The WTE industry directly employs about 5,350 people nationwide. The WTE sector also creates an additional 8,600 jobs outside of the sector for a total of nearly 14,000 jobs. Employees at WTE plants are technically skilled and are compensated at a relatively high average wage, receiving about \$460 million in annual salary and benefits. The effect of this direct spending on employee compensation generated another \$429 million of compensation for workers across various associated industries. In addition to the revenues generated by the sector, WTE facilities provide stable, long-term, well-paying jobs, while simultaneously pumping dollars into local economies through the purchase of local goods and services and the payment of fees and taxes.

WTE Ownership



MARKET OUTLOOK

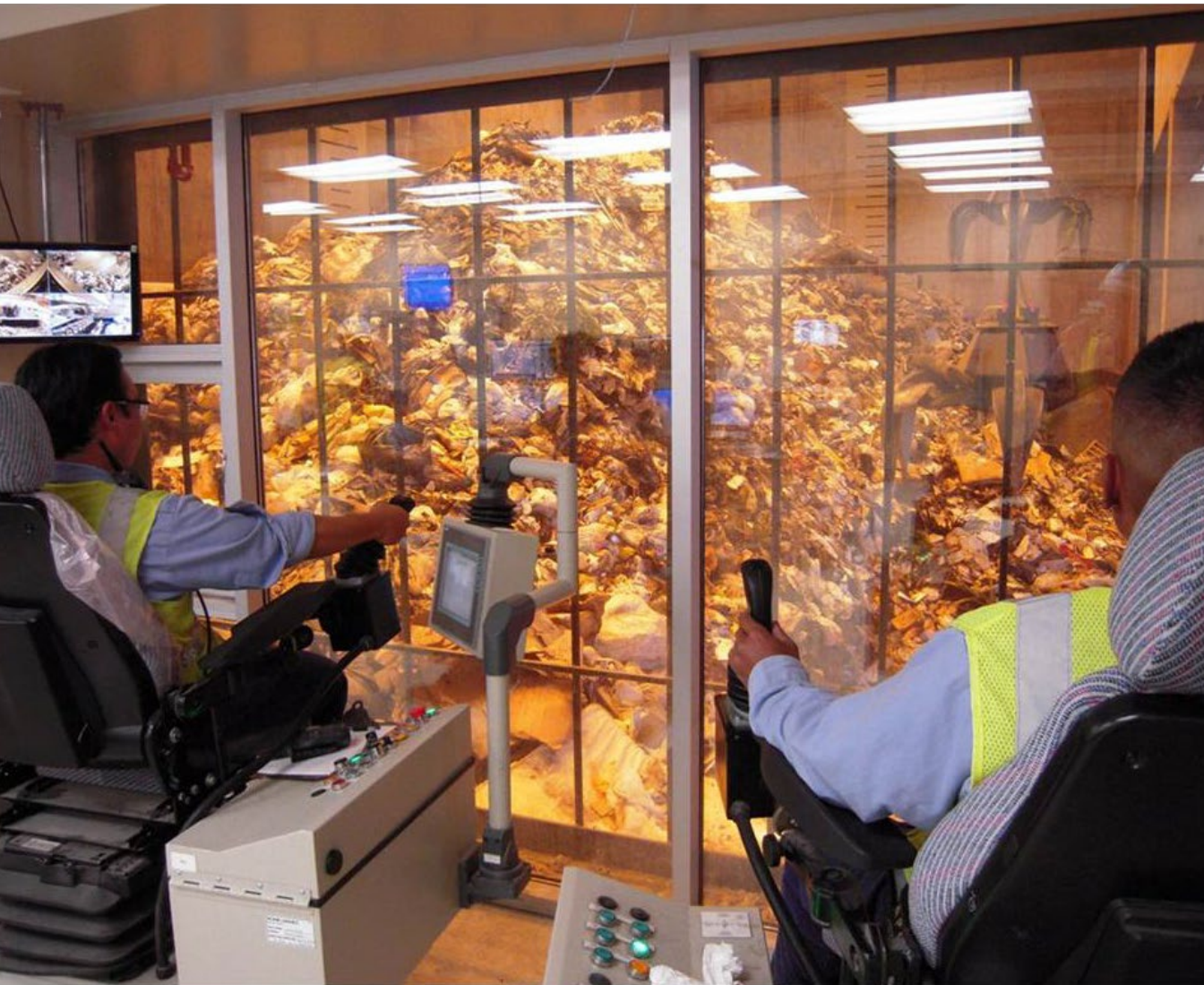
In 2011, almost 390 million tons of trash were generated in the U.S., and only 29% of it was recycled. Post-recycled waste is an abundant and readily accessible resource with inherent energy value, which can support large increases in domestic WTE capacity. The U.S. is fortunate that waste-to-energy is a proven and mature technology with a track record of operational success, high availability, and overall reliability. However, these facilities must still compete in extremely difficult market conditions, not only for energy but for waste management. These market conditions present challenges for all renewable technologies, but the recognized need for sustainable waste management tools and a diverse electric generating mix make waste-to-energy attractive.

In the past seven years, six WTE facilities have expanded their existing capacity to increase the amount of waste they can process and increase the amount of energy they produce. In the aggregate, these expansions added 2,540 tons per day of additional waste capacity and 54 MW of electric capacity, as well as additional steam exports to end users. The industry expects further opportunities to expand existing facilities in the next five years. In addition, development of greenfield facilities is occurring for the first time since the 1990s. Palm Beach County in Florida is constructing a new 3,000 ton per day WTE facility which will have an electric generating capacity of 96 MW. Furthermore, Maryland has issued permits for new WTE facilities to be constructed and operated in Baltimore and Frederick. Many other municipalities are in discussions with technology developers to provide new WTE capacity locally although the lead times for developing and constructing facilities are generally very time consuming.

The development of new facilities is closely tied to the energy markets in which they participate, which are currently heavily influenced by the availability and price of natural gas. Wholesale electricity prices have been extremely challenging in recent years, which drives down revenues from renewable electric generation. However, waste-to-energy is in a unique position, in that electricity revenues are typically less than half of the total revenue earned by a WTE facility. The majority of revenues are derived from waste tipping fees, so there is some insulation from energy prices. However, waste markets are extremely competitive given the vast amount of land in the U.S. in which it is possible to site price competitive landfills.

All 84 municipal solid WTE facilities in the U.S. use combustion technology. However, many companies are working to deliver technologies based on other thermal conversion processes, such as gasification or pyrolysis. These technologies offer the potential to produce an array of end-use products, such as electricity, steam, fuels, chemicals, or other products. While these technologies do not operate commercially utilizing MSW in the U.S., companies and local governments are exploring opportunities to commercialize these emerging technologies in the domestic marketplace.

Municipal solid waste is a universal resource, generated in every place in the U.S. where people are located. Historically, the economic model of WTE technology works best in areas with high population density, because waste is generated in large volumes locally (minimizing transport) and the prospect of siting additional landfill space is more difficult. While densely populated areas will continue to be a prime target for WTE deployment, communities interested in sustainable waste management options will continue to pursue WTE technology. In addition, regions with limited transmission may seek waste-to-energy, because the electricity can be generated where it will be consumed.



H-POWER waste-to-energy facility in Honolulu



The success, or failure, of federal policy can have tremendous influence on energy technologies. The Public Utility Regulatory Policies Act of 1978 had an enduring effect on the WTE industry. However, the production tax credit (PTC) failed to provide the same stimulus, given that the duration of the PTC has always been less than the typical development window for a WTE project. This is due in part to the structure of the PTC, which as a practical matter cannot be used by WTE facilities because of, among other reasons, the long lead times and unique permitting and engineering requirements associated with these otherwise economically competitive projects. The ability of other renewable energy technologies to use the PTC and ITC, while WTE technology is effectively denied access to similar tax treatment for which it is eligible, puts WTE technology at a distinct competitive disadvantage in the energy marketplace. Unless there is a stable and predictable national policy for energy or solid waste, WTE development in the United States will not reach its full potential. In addition, state renewable portfolio standards have blossomed over the last decade, but the vast discrepancy of renewable credit market values among states and renewable technologies often provide less assistance than is necessary.

Development of waste-to-energy in the United States has paled in comparison to the development in Europe and in Asia. For example, policies in Europe aimed at reducing landfills have provided economic incentives that led to the widespread adoption of waste-to-energy and recycling. U.S. companies engaged in the WTE sector have recently invested development dollars in markets overseas that have more favorable renewable policies than found domestically.

RECOMMENDATIONS TO POLICYMAKERS AND THE INDUSTRY

MSW continues to be generated in vast quantities, and there is inherent valuable energy contained within that can be extracted through WTE technology. While WTE technology is proven and mature, innovations are continually being developed to increase efficiency, reduce emissions, enhance energy extraction, reduce costs, and enhance sustainability. However, the market signals in the U.S. are set almost entirely by the lowest cost methods of energy generation and solid waste management.

In order to maximize the deployment of WTE technology, as well as all renewable energy technologies, federal energy policy must recognize the unique development challenges and long lead times of certain technologies. History has shown that not all renewable incentives treat all technologies equally. Policymakers should ensure that incentives provide renewable energy developers long-term predictability, as well as flexibility to meet a project's specific situation (such as an election to choose between a production tax credit and an investment tax credit).

Providing a long-term policy in the Internal Revenue Code that gives municipalities and private industry the ability to make long-term financial decisions is crucial, to avoid putting waste-to-energy at a disadvantage with other renewable technologies due solely to the long-lead times associated developing these projects. It typically takes more than five years to complete the required negotiations with municipalities as well as the permitting, financing, engineering, and construction of a WTE facility. Creating incentives that recognize the unique challenges of each technology is essential. As an example, waste-to-energy is the only renewable technology which must begin its development process by negotiating contracts for waste disposal with local governments. One way to recognize this unique challenge is by allowing WTE facilities to access incentives when a written binding contract is signed with one or more local governments. Such innovative policies will help give the appropriate market signal and allow more facilities to enter the development pipeline.

ABOUT THE ENERGY RECOVERY COUNCIL

ERC is the national trade association representing companies and local governments engaged in the waste-to-energy sector. There are 84 waste-to-energy facilities in the United States, which produce clean, renewable energy through the combustion of municipal solid waste in specially designed power plants equipped with the most modern pollution control equipment to clean emissions. America's waste-to-energy plants have a baseload electric generation capacity of more than 2,700 megawatts. These facilities process approximately thirty million tons of trash per year and recover valuable energy from the waste, enabling these facilities to send nearly 15 million megawatt hours of electricity to the grid, as well as export steam to local users. ERC's members include companies in the waste-to-energy industry and 30 local governments, which own and/or operate waste-to-energy facilities. For more information, contact tmichaels@energyrecoverycouncil.org.





The Outlook for **ETHANOL**

The renewable fuel standard (RFS) has been a resounding success story. The RFS is the primary driver behind the only large-scale, commercially-viable alternative to regular gasoline—ethanol. Ethanol has reduced our dangerous dependence on foreign oil and made our nation more energy independent, created American jobs, revitalized rural America, injected much-needed competition into a monopolized vehicle fuels market, lowered the price at the pump, and improved the environment. Ethanol's record is a great record of successful accomplishment.

Today, ethanol represents nearly 10% of our nation's fuel supply—producing over 14 billion gallons of American-made biofuels—and is poised to do much more. Specifically, ethanol has helped lower our dependence on foreign oil by 33%, supports nearly 400,000 American jobs, generates more than \$44 billion in economic activity, and has lowered the price at the pump for all American drivers. In 2012, a study done at Louisiana State University estimates consumers saved \$0.80 per gallon, resulting in over \$100 billion in total savings.

These are real, tangible results that benefit every American. However, we are at risk of turning back on this progress if we repeal the RFS and allow the world's largest oil companies to shut out competition, maintain their stranglehold on the wallets of American drivers, and do little to wean our nation off of imported fossil fuels.

Growth Energy sees a different path forward. The RFS and higher-level ethanol blends present the first real opportunity to create fuel diversity in the United States. Over 100 years have passed since Americans had a choice about what fuel they use in their automobiles. The premise that America's newfound oil and gas resources mean the country no longer needs renewable fuels is simply not true. This year, we are going to import almost \$400 billion worth of petroleum, much of it from members of the Organization of Petroleum Exporting Countries (OPEC). These imports take money away from our economy—just like a per capita tax on each and every American of about \$1,200.

Biofuels like ethanol keep those funds inside our economy, creating jobs and building communities. Every 1% of ethanol injected into our fuel supply retains over \$3 billion in our own economy.



Tom Buis
CEO, Growth Energy

Since the inception of the RFS, the ethanol industry has produced ample biofuel to meet the statutory goals of the RFS, and it has the capacity to continue to do so. When the RFS was first created, it was apparent that the nation's energy infrastructure and economy needed greater market access for renewable fuels. In the fuel-use assumptions in 2007, when the RFS was expanded, it was understood that higher-level ethanol blends like E15 and other mid-level ethanol blends like E30 would be required in order to meet the volumes contained in the statute. Five years ago, Growth Energy led the way by filing a waiver with the U.S. Environmental Protection Agency (USEPA) to allow the sale of ethanol blends up to E15, beyond the current 10% ethanol in today's current fuel supply. By moving the nation to E15, we will further constrain the price at the pump, add 136,000 new American jobs, further limit greenhouse gas emissions, and reduce the demand for gasoline produced from foreign oil by up to 7 billion gallons. In addition, E15 would reduce the use of aromatics in gasoline, which are petroleum-derived fuel components known to harm human health.

Unfortunately, the oil industry has decided to erect numerous public relations, legal, and regulatory hurdles to avoid marketing fuel containing more than 10% ethanol. Instead of working to accommodate mid-level ethanol fuel blends that provide choice for consumers, the oil industry has chosen to attempt to shut out competing fuels from their vertically integrated monopoly. Because the oil industry continues to stifle fuel choice at the pump, most consumers do not have access to E15 or other mid-level blends, even though over 80% of the vehicles on the road today can safely use E15. Sales have been robust at fueling stations that offer E15, because E15 is less expensive, safe for use, and produces high-performance. Higher blends are important not only for today's market, but also to spur the development of the next generation of biofuels.

The RFS is the bedrock federal policy that continues to spur billions of dollars of investment in America's cutting-edge biofuels industry. Because of the forward-looking, long-term nature of the policy, the U.S. leads the world in innovation in biofuels, attracting investment from around the globe. Today, because of the certainty provided by the RFS and the success of American ethanol, there are more than 200 existing ethanol biorefineries across the country considering projects that would produce advanced or cellulosic biofuels.

In fact, commercial production of advanced and cellulosic biofuels is occurring now. Several members of Growth Energy are producing these fuels because of the market signals and certainty provided by the RFS:

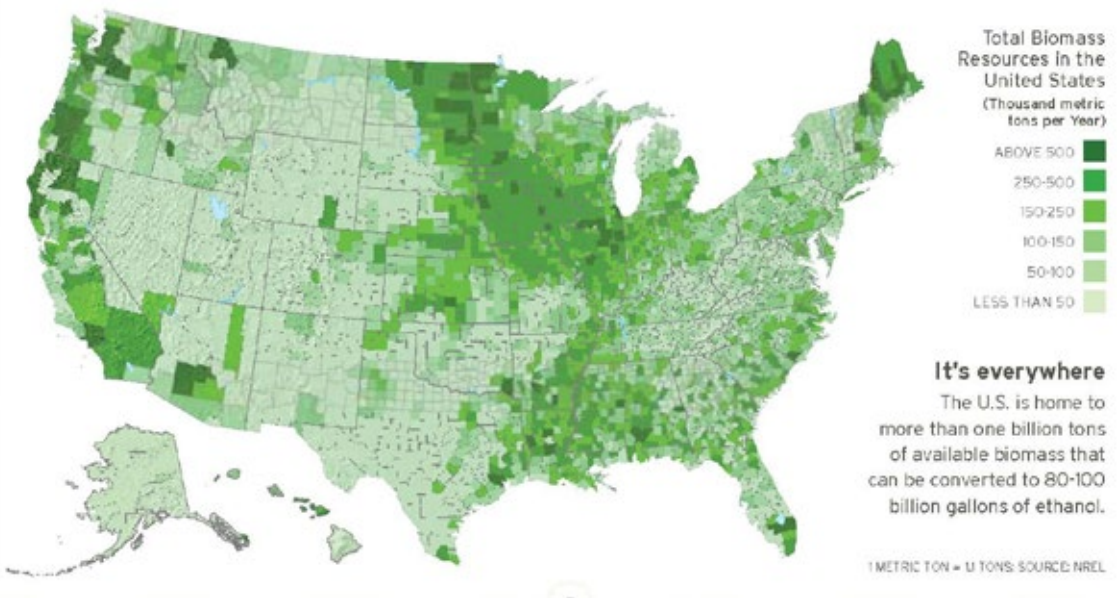
- Three cellulosic ethanol plants will come on line this year, producing the first commercially available cellulosic biofuel from corn stover and other agriculture waste
- A first of its kind algae bioreactor using carbon dioxide and waste water has been in operation for over two years
- A project is underway to use wood from trees killed by pine beetles as a fuel feedstock



- Ethanol producers are developing a process to convert the fiber from corn kernels into cellulosic ethanol
- Grain sorghum and biogas from a manure digester are being used to produce advanced biofuel

Cellulosic Ethanol

The “50 State” Solution



The advanced and cellulose fuels now being developed will provide benefits and economic opportunity to every state in the nation. Changing the RFS puts an entire American-made, American-built industry at risk, as well as jeopardizing critical research and development of advanced and cellulosic biofuels, which will occupy the largest portion of the RFS market in the future.

RECOMMENDATIONS

As policy makers look toward the future, there are a number of actions that can be taken to continue this energy success:

1. Continue to move the RFS forward and not backward by reducing the volumes outlined in the original statute. Moving backwards on the volumes would only stifle investment

and do nothing to reduce our dangerous dependence on foreign oil or improve the environment.

2. It is imperative to remove regulatory and market hurdles to E15 and other higher ethanol blends. By giving retailers the choice to sell these products year-round, they can give consumers something that they have not had for nearly a century—a true choice of fuels at the pump and access to cost-competitive American-made biofuels.
3. Federal regulators should continue to give automakers appropriate credit for the use of ethanol. There are over 16 million flex fuel vehicles (FFVs) on the road today that offer the consumer the ability to use ethanol blends up to and including E85. Without giving automakers appropriate credit for offering FFVs, it will be nearly impossible to get higher ethanol blends into the marketplace and ultimately to fulfill the ambitious goals of the RFS. The major U.S. automakers have committed to producing 50% of their fleet as flex fuel vehicles, and they should get appropriate recognition for vehicles that use fuels that greatly improve our nation's air quality.
4. Our nation should look at a high-octane, midlevel ethanol blend such as E30 because of its significant benefits to the environment as well as to the wallets of consumers. Growth Energy has provided the U.S. EPA a great deal of data that shows how a high-octane, midlevel ethanol blend can be implemented and how this super-fuel can greatly reduce harmful toxins in the air.

The bottom line is that the RFS is a policy that is working and that benefits all Americans. With oil prices at \$100 a barrel and gasoline continuing to be above \$3.25 per gallon, we can no longer afford to be 90% dependent on fossil fuels. The key to reducing prices at the pump, providing consumers real choice, and ensuring our energy security is to inject competition into the transportation fuel sector. With ethanol, we will continue to cut greenhouse gas emissions, reduce our dangerous dependence on foreign oil, and create American jobs.

ABOUT GROWTH ENERGY

Growth Energy is the leading trade association for America's ethanol producers and supporters. Growth Energy represents 82 ethanol production facilities, 83 associate members, and thousands of ethanol supporters across the nation. We promote expanding the use of ethanol in gasoline, decreasing our dependence on foreign oil, improving our environment, and creating American jobs. Ethanol is a home-grown, renewable fuel that provides significant benefits to our nation. We vigorously support the Renewable Fuel Standard (RFS) and the expanded use of ethanol in our nation's fuel supply as it significantly reduces prices at the pump for American consumers and improves our air quality.





The Outlook for

BIODIESEL AND ADVANCED BIOFUELS

OVERVIEW

The world has witnessed a sea change in the drivers of energy production and demand. Moving toward 2035, a minimum of three factors will play heavily in terms of how the United States considers its energy future: supply, demand, and public policy. In 2009, Cambridge Energy Research Associates, in their *Future of Global Oil Supply* report, suggested that by 2030 the world would demand around 110 million barrels of oil a day and that, despite new liquid resources, current oil reserves, fields under development, and production from unconventional liquids, there would be a gap of 35 million barrels a day that would need to be filled. Recent modeling continues to support this, as the U.S. Department of Energy's (DOE) Energy Information Administration (EIA) *AEO2013* estimates global petroleum and liquid fuel consumption for 2040 to be between 111 million and 118 million barrels per day, forcing new production of liquid fuels from biomass, coal, and natural gas.

At a minimum, these numbers suggest America should not just adopt an “all of the above” energy strategy, but rather an “everything and the kitchen sink” strategy. In its 2014 *Energy Outlook*, BP forecasts energy consumption to rise 41% by 2035 with 95% of that growth coming from rapidly growing, emerging economies. Of that demand, BP forecasts North American demand to increase by 5% between 2012 and 2035. In their analysis, the previous energy demand peak seen in 2007 is not forecast to return until at least 2023, with a trend of demand declining after 2035. Although the U.S. is not forecast to return to the 2007 demand peak, we operate in a world energy market, and worldwide demand and shortages will directly impact the prices American consumers pay at the pump.

If these numbers are in the ballpark, that is cause for serious review of the public policy tools available to preserve economic development, stir innovative technology deployment, and address sustainability issues, such as air pollution, water use, and the potential for climate change.



Advanced
Biofuels
Association

Michael McAdams

*President, Advanced Biofuels
Association*

ABFA believes these issues can be an opportunity and driver for advanced and cellulosic biofuels. According to a February 2014 report from Navigant Research, worldwide biofuels production was about 32.4 billion gallons total in 2013. Around two thirds of the total is produced in the United States and Brazil. In 2013, the U.S. Environmental Protection Agency (EPA) mandated the use of 16.55 billion ethanol-equivalent gallons of biofuel, and we were able to hit that target. The overwhelming majority of U.S. biofuels production came from the corn ethanol sector, with over 13.1 billion gallons reported on EPA's Moderated Transaction System (EMTS). But notably, the growing advanced biofuels industry produced a record 3.23 billion gallons in 2013. Of this, cellulosic biofuels, which have the largest growth potential, contributed approximately one million gallons.

MARKET OUTLOOK

Over the next five years, cellulosic technologies will begin commercial deployment in earnest. This year alone we expect to see the first substantial volumes of cellulosic fuels from multiple new facilities. These plants range from in production capacity from eight to thirty million gallons a year with the majority making cellulosic ethanol and one making cellulosic gasoline and diesel. Other advanced biofuels plants utilizing a wide range of oil-based feedstocks will be making renewable diesel. If existing market conditions allow, companies such as Neste Oil, Dynamic Fuels, Honeywell UOP, and Valero could potentially see the largest number of gallons produced in this category ever, an amount roughly equal to 400 million actual gallons. Their fuels, cellulosic and advanced gasoline and diesel, are known as “drop in” fuels because they require no changes to existing planes, trains, and automobiles and can be “dropped in” to the existing pipeline and distribution system. In fact, the Colonial Pipeline has already created a set of specifications for drop-in biofuel use within the system.

One of the great advantages of advanced biofuel technologies is the diverse set of feedstocks from which they can be produced, and the resulting potential geographic diversity of their deployment within the United States. With the passage of the recent Farm Bill and a strong commercial and federal commitment to develop energy feedstocks, such as giant miscanthus, biomass sorghum, and others, land previously unable to grow value crops can be put into production to provide these new biorefineries with low-cost feedstocks that are high in biomass density per acre. This is also an unprecedented opportunity for economic growth in rural communities.

As a result of the renewable fuel standard (RFS), the United States continues to be in the forefront of global development of advanced and cellulosic fuels. However, this important policy must be consistently implemented and supported by both the Executive and Legislative branches of government. Recent efforts to repeal the law in Congress, and a woefully inadequate proposal for the RFS's targets in 2014 from EPA, have dealt a serious



blow to those companies seeking capital to build their first commercial plants. Concern over the policy stability of the RFS has also had a negative impact on new startups and investor confidence in the industry.

On the other hand, the new Farm Bill includes \$881 million for energy programs, including support for bioenergy crop production and biorefinery construction for fuels and chemicals. The U.S. military continues to lead the way on developing and using alternative fuels and is working jointly with the Department of Energy and Department of Agriculture on a \$510 million initiative for defense use of drop-in advanced biofuels. This federal leadership is invaluable in moving technologies to commercial scale.

But without a steady and consistent federal policy, this industry will struggle to keep this remarkable momentum going. Not only are there regulatory hurdles to overcome, and a vigorous Congressional debate over the RFS to endure, but also on-again/off-again tax policy and an unequal playing field that continues to create fresh challenges for new producers. When Congress allowed all of the biofuels tax provisions to expire at the end of 2013, it sent inconsistent signals to smaller, newer, players who have made investments dependent on the federal policies in place since 2005.

Many in the industry believe these inconsistencies reflect the government going back on its promise to those who have put up their own money to build the future generation of plants. According to Bloomberg New Energy Finance, the biofuels industry has invested \$14.7 billion in the last six years to provide the research and development and build pilot, demonstration, and commercial plants. This will become stranded capital if we do not continue to send a clear signal of support from all branches of the federal government.

CONCLUSION

Advanced biofuels have made great progress in building an advanced and cellulosic industry. We hold great promise in a world which continues to see significant demand for transportation fuels. ABFA continues to believe that advanced biofuels, particularly drop-in fuels, can make a significant contribution to addressing the sustainability goals of the global airline and maritime transportation sectors. These sectors represent a growing proportion of greenhouse gas emissions, and our fuels can significantly reduce their footprint.

ABFA welcomes the opportunity to participate with ACORE, salutes their efforts in regard to the development and deployment of all renewable technologies, and stands ready and interested to engage the readers and participants who wish to further discuss the challenges the advanced biofuels sector must navigate and the contributions we may deliver.

ABOUT THE ADVANCED BIOFUELS ASSOCIATION

The Advanced Biofuels Association (ABFA) represents advanced and cellulosic biofuel producers, next generation biomass feedstock growers, and bio-based and renewable product manufacturers. Our organization was founded in May of 2007 and is an established 501(C)(6) trade group certified in the District of Columbia. For more information on our members and advocacy work, please visit our website at www.AdvancedBiofuelsAssociation.com. For more information, contact Michael.McAdams@hklaw.com.





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