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Alternative thinking 2016

Five game-changers powering the future of renewable energy

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Introduction

In the three years since we last published an edition of ***Alternative thinking*** much has occurred in the world of energy – so much, that the landscape itself has visibly changed. Look around. At some point in your daily travels, potentially on your very own street, you'll likely see rooftop solar panels, utility-scale solar photovoltaic (PV) arrays, wind turbines, and/or electric vehicle charging stations. This doesn't even include the activity going on behind the scenes, such as biomass-to-electric plants, new energy storage systems, and biofuel blends at the pump.

Despite lingering regulatory and technical hurdles, an enormous perceptional shift concerning alternative energy has occurred: renewables are now seen as normal. And, they are increasingly being chosen over fossil fuels as the preferred method for meeting growing global electricity demand, which is projected by the US Energy Information Administration to increase by 1.9% per year from 2012 to 2040.[1]

While the International Energy Agency reports that renewables account for only a small portion of total global electricity generation (i.e., 22% in 2013), it is unlikely this will be the case for long.[2] According to a report published by the United Nations Environment Programme, 2015 was a record-breaking year for renewable development in three major respects.[3] First, global investment reached nearly USD 286 billion in 2015, up 5% from the previous year.[4] Second, a record of 134 gigawatts (GW) of capacity was installed, up from 106GW in 2014.[5] And third, developing economies became major players, investing an all-time-high USD 156 billion in renewables in 2015 (excluding large hydro-electric projects of more than 50MW), up 19% from the previous year.[6]

What's so remarkable about this growth is that it occurred despite persistently low natural gas prices and, subsequently, low wholesale electricity prices in some regions. This has made the competitive environment for renewables much tougher than it would have otherwise been.

There are many reasons we are seeing so much progress so fast in the world of renewable energy and why the march forward is likely unstoppable. This report will delve into these game-changers, examine remaining barriers, and challenge the prevailing view of what's possible by presenting some "what-if" scenarios that could potentially propel the renewable power sector ahead with lightning speed, perhaps far outpacing current projections, should they come to pass.

Jane Allen
Global Leader, Renewable Energy
Deloitte Touche Tohmatsu Limited

#1

Regulatory reform and public policy support

Far-reaching regulations at global, national and local levels are driving increased adoption of renewable energy.

The 2015 United Nations Climate Change Conference was held in Paris, France, in December. It was the 21st convening of the Conference of Parties (COP) to the 1992 United Nations Framework on Climate Change, thus earning it the moniker of COP21. More than 175 countries endorsed the resulting UN Paris Climate Change Agreement, setting an all-time record for the highest number of countries signing an international treaty.[7] The Agreement sets a collective goal of "keeping global warming below 2°C compared to pre-industrial times, and to pursue efforts to limit the temperature rise to 1.5°C.[8]" Furthermore, it requires all countries "to submit plans for climate action and to update them every five years, though such plans are not legally binding."[9] This represents a significant alignment, or "meeting of the minds" regarding climate change, the likes of which has never been experienced before. The momentum from the treaty will undoubtedly have a positive effect upon renewable development, even if some countries don't follow through on the agreement.

While historic, the COP21 treaty appears to be just one aspect of a much broader regulatory reform movement. Supportive regulatory constructs are additionally being developed at the national level in many countries.

For instance, the Clean Power Plan (CPP) from the US Environmental Protection Agency puts the first-ever limits on carbon emissions from power plants in the US, aiming to bring them approximately 32% below 2005 levels by 2030.[10] While the CPP sets guidelines for reducing carbon emissions from electricity generation, the states are responsible for setting standards of performance and proposing plans for compliance. The impact of the CPP upon the renewable energy sector will ultimately be determined by two types of entities: the states, since they decide which renewable resources to include in their compliance strategies; and the courts, since opponents are contesting some provisions. To date, 29 states and state agencies are in legal opposition to the rule, while 18 states and Washington, D.C. have filed motions in support.[11] At issue in many instances is state versus federal authority in defining and enforcing the plan, along with debate about who should bear the costs of compliance. Ironically, 61% of the public supports the CPP in the states suing to stop it.[12] This suggests that the will of the people will eventually prevail and some form of the Plan will be enacted.

"In North America, we need to move to a model that provides incentives for energy conservation to reduce power consumption and to use alternative forms of energy generation. In many places, it's the opposite: utilities are compensated to a greater degree when customers use more electricity."

Jane Allen
Global Leader, Renewable Energy
Deloitte Touche Tohmatsu Limited

Policy support is also strong at the state and provincial levels. In Canada, provincial leaders have agreed to a framework for clean growth and climate change. The framework addresses clean technology, innovation and jobs, carbon pricing and mitigation, and it encompasses all Canadian provinces, even Alberta, whose economy is heavily dependent upon unconventional oil and gas production from the oil sands.[13] The federal government has additionally agreed to support the framework by taking a number of actions, such as working to supplant usage of diesel generation with renewable, clean energy in indigenous and remote communities, and doubling its investments in clean energy, research and development over five years.[14]

In the U.S., New York state has made headlines with its Reforming the Energy Vision (REV) plan, which proposes to overhaul the state's energy grid and utility regulatory system in an effort to achieve system-wide efficiency, reliability, resiliency, fuel diversity, affordability, carbon reduction, and increased customer choice and value.[15] In pursuing these objectives, the plan is expected to promote deeper penetration of wind and solar as well as to reshape the utility business model by restructuring wholesale and retail electricity prices and incentivizing utilities to deploy distributed energy resources. As the most extensive initiative introduced to date, it will likely provide a framework for other states if it is successful.

What if ...

... rooftops are required to go green?

In March 2015, France decreed that all new rooftops in commercial zones must be covered in plants or solar panels.[16] In April 2016, San Francisco, California, made history as the first major US city to require new buildings to have solar panels installed on the roof.[17] Green roofs are already popular in Germany and Australia, and Toronto, Canada, mandated them in new industrial and commercial buildings larger than 2000 sq. metres in 2009.[18] If the "passive house" or zero-energy building movement continues to gather steam around the world, what would this mean for solar panel manufacturers and the makers of cutting-edge technologies, such as building integrated solar photovoltaics that embed solar cells into insulated windows and architectural glass? Regulations such as these could play a critical role in making markets for new energy management products and accelerating adoption of renewables. They could also help with overcoming the biggest barrier to adopting green products in the construction industry, which surprisingly is awareness, and not cost. Architectural firms and engineering, procurement and construction contractors are often late to the party because they are unfamiliar with new products and how to obtain them, or they lack confidence in how they'll perform.

#2

Corporate commitment

Large global companies have launched a movement to generate all of their energy from renewables in the next two decades.

As of this writing, 58 multinational corporations have made the commitment to go 100% renewable through the RE100 – a collaborative, global initiative of influential businesses committed to 100% renewable electricity, working to massively increase corporate demand for renewable energy.[19] Notably, the companies joining the RE100 hail from all over the world, including Infosys and Tata Motors of India, and Elion of China.[20] This suggests that the business case for renewable energy and the support for de-carbonization are not merely regional phenomena of relevance to developed economies. In addition to the RE100, a similar coalition of companies has evolved in the United States. As of December 2015, 58 leading multinational corporations have signed on to the Renewable Energy Buyers' Principles, a US initiative that aims to make renewable energy easier for companies to procure at a large-scale.[21] The signatories to date represent nearly 44 million megawatt hours (MWh) of annual renewable electricity demand by 2020.[22]

In addition to procuring power directly from producers through power purchase agreements (PPAs), many companies are also choosing to self-generate a portion of their electricity supply to better manage their electricity costs, support sustainability goals, and improve resiliency.

"Companies in the mining and industrial sectors need to look at renewables as a way to accelerate shareholder value now before everybody else does it. If you're a commodities business, you'll be earning commodity returns unless you do something different."

Michael Rath
Deloitte Energy & Resources Leader
Asia Pacific

Early movers such as IKEA, Google and BMW Group have already invested heavily in installing their own renewable energy solutions (e.g., solar PV arrays, rooftop installations, wind turbines, fuel cells, energy storage solutions, microgrids, etc.).[23]

And, the popularity of self-generation will grow as the business case strengthens in terms of cost savings, social license to operate, and improved resiliency to major weather events. At present, self-generation is particularly appealing for large commercial and industrial energy users that operate in remote locales

with little existing infrastructure, such as mining. Here, solar PV installations and wind turbines can be combined with energy storage mechanisms, such as compressed air, batteries and pumped hydro, to help lessen reliance on diesel generation, which is costly and emissions-intensive. And, hybrid solutions like these have the added advantage of being able to stand on their own, thus allowing companies to avoid the extra expense of building transmission lines to connect with the grid.

Today, many corporations are combining a variety of self-generation solutions with PPAs to move toward their aggressive renewable energy targets. Why are businesses becoming so keen on procuring, producing and consuming clean energy? Their motives are multifaceted. About eight in ten US businesses surveyed in the **Deloitte Resources 2016 Study***[24] say energy management is increasingly important to remaining competitive from a financial perspective and an image perspective. Furthermore, renewable power is cost-competitive with fossil fuels in many regions today even without government subsidies; it provides a hedge against future fuel price volatility; it strengthens resiliency and preserves business continuity in the event of a black swan event; and perhaps most importantly; customers, particularly members of the Millennial generation (ages 18-34) are demanding it.

*Deloitte Resources 2016 Study, Deloitte
**2016 Deloitte Millennial Survey

"Renewables can offer great benefits to mining companies such as the ability to provide a secure source of energy, greater reliability, hedge against short-term fuel price volatility and long-term fuel price increases, reduced greenhouse gas emissions and better economics than existing options in a growing number of locations."

Adriaan Davidse
Director, Consulting
Deloitte Canada

What if ...

... Millennials spur exponential growth of alternative energy?

The Millennial generation, defined here as those born after 1982, are a growing force throughout the world. The **2016 Deloitte Millennial Survey****[25] collected the views of more than 7,700 Millennials representing 29 countries around the globe, and found that this generation thinks differently and collectively. They are deeply guided by their personal values, which they often put ahead of organizational goals, and they are prone to shun potential employers whose actions conflict with their beliefs. Millennials have recently surpassed Baby Boomers (ages 49-67) as the largest living generation in the US, and they are fast-approaching this threshold in other countries.[26] Many of these young people have already begun choosing their energy sources and modes of transportation based on environmental and social criteria and not just cost.[27] As Millennials increasingly become an economic force to be reckoned with, some contend they could drive exponential growth in alternative energy, pushing renewables over the remaining cost-parity hurdles with conventional forms of electricity generation.

#3 Financing innovation

Investors now understand renewables as an asset class and are more confident in investing in them, while new financing vehicles have lowered the cost of capital and improved access to it.

Coal and gas-fired electricity generation in 2015 drew less than half the record investment made in solar, wind and other renewables capacity, marking an important first for renewable energy.[28] Notably, the renewables sector surpassed this milestone in spite of record-low prices for fossil fuels, which make conventional generation more attractive. Drivers behind this trend include greater confidence in the technology, improving economics of renewable energy, the growing push toward greener forms of energy around the world, and importantly, the widespread availability of cost-competitive financing for renewable projects.

Financing conditions have improved broadly for renewables over the past couple of years due to the advent of new financing vehicles and the resurgence of some existing mechanisms. Take YieldCos for instance. Introduced to the renewable energy sector in 2013, YieldCos are publicly traded companies formed to own operating assets that produce cash flows, which are then distributed to investors as dividends.[29] YieldCos generally offer public equity investors an attractive total return proposition of growth plus yield.

Originally well-received by public markets, the model has recently come under pressure from broad turbulence in energy markets, with some investors fleeing the sector. Despite these pressures, stronger YieldCos have stayed on course by standing firm on their dividend payments. These market developments, while disconcerting, may ultimately benefit the sector. As in any nascent class, there will be winners and losers in the face of adversity, and future consolidation is anticipated, ultimately strengthening the YieldCos landscape over the long-term.

While important, YieldCos are not the only new development in the world of alternative energy financing. Green bonds, or "climate bonds," have become a significant source of capital for the renewables sector. These instruments are essentially corporate bonds with proceeds ring-fenced for clean energy investments. The International Finance Corporation was one of the earliest issuers of green bonds. As of November 2015, it has issued USD 4.3 billion in green bonds, including two benchmark USD 1 billion issuances that were, at the time, the largest such issuances in the markets.[30]

More recently, two Chinese financial institutions captured attention in the first quarter of 2016 by issuing green bonds worth approximately 30 billion Yuan, or USD 4.5 billion.[31]

Tax equity has returned as a major driver in the US renewables market. With the recent extension of the US Investment Tax Credit for solar and the Production Tax Credit for wind, traditional tax equity financing is once again viable in the US. Right now, some contend there is a huge pool of tax equity investors who are poised to handle the projected growth of wind and solar development in the US over the next five years. By giving companies the opportunity to reduce their tax burdens, this development bolsters the trend of corporations investing in renewables by making the overall financial proposition even more attractive.

"Tax equity investments are a great opportunity to build a business case that satisfies two business goals: financial effectiveness and sustainability. Now it's just a matter of making companies comfortable with the transaction."

Marlene Motyka
Alternative Energy Leader
Deloitte US

What if ...

... the rise of the sharing-economy opens the funding floodgates?

YieldCos changed the investment landscape by opening the door for the average investor to purchase shares in pooled renewable energy assets. But, what if the door swings wide open? Some believe the rise of the sharing economy will spill over into the renewables sector, propelling the growth of community solar, crowd-funding, and other forms of shared participation in renewable energy development. This could create vast pools of funding for clean energy projects while allowing the huge numbers of apartment dwellers, and others whose properties or budgets aren't suitable for implementing renewable solutions, to share in the risks and rewards.

#4

Energy storage

Energy storage technology is advancing and making renewable energy more viable by eliminating the issue of intermittency.

Energy storage is a broad term encompassing a wide range of chemical technologies, mainly batteries, along with mechanical/thermal technologies, such as flywheels, compressed air, pumped hydro, and molten salt. Contrary to popular belief, energy storage is not something new. In fact, it has been around in some form since the inception of the power and utilities industry. Yet, a widespread misconception exists: many business people, including purchasing decision-makers, still believe that energy storage technologies are neither viable, nor affordable, particularly for utility-scale or large commercial and industrial applications. While the situation varies greatly across regions, energy storage, by and large, is demonstrating itself to be an effective tool for regulating and managing intermittent power sources, partly due to corporate interest in the sector and regulatory mandates that are boosting adoption of new storage technologies and helping to drive down costs. This is causing some to speculate that the missing piece of the sustainability puzzle may have been found – and a revolution may have been spawned.

Research into electricity storage has identified five broad families of applications:

- Electricity supply — Generally at grid-scale where storage is used either to add additional capacity at peak periods or to shift electricity generation over time from an off-peak period to an on-peak period, usually within the same day.
- Ancillary services — Includes items such as provision of reserve or surge capacity, load-balancing across the grid, and voltage support, all of which assist the grid operator in maintaining quality and reliability of electricity delivery.
- Grid support — Relieves congestion on the transmission grid, allows deferral of expensive transmission system upgrades, or provides on-site power for sub-stations across the system.
- Renewables integration — Allows the time-shifting of renewable power inputs into the grid and the management of intermittent capacity.

- End-user — Often, but not always, associated with distributed generation, these applications include maintaining electricity quality and reliability, matching distributed generation delivery with time-of-use requirements, and allowing consumers to more effectively manage their exposure to demand charges.[32]

Across these diverse applications, the energy storage revolution is picking up speed and capturing the attention of investors and corporations around the world. For instance, French oil giant, Total, recently announced a USD 1.1 billion scheme to buy battery group Saft, while Nissan announced a pilot project in the UK that will plug 100 of its Leaf cars into the electricity grid, using their batteries as extra storage.[33,34]

And, no discussion of energy storage is complete without mention of the highly publicized Tesla Powerwall, a home battery designed to charge using electricity generated from solar panels, or when utility rates are low. Now being produced in the Tesla Motor Company's "gigafactory" in the Nevada desert, the Powerwall offers the promise of independence from the utility grid and the security of an emergency back-up.[35] While critics contend that it is over-hyped, the storage system nonetheless sold out within a week after it was first announced in late April 2015.[36] Even more, Tesla is not alone in the market: Aquion, Redflow and Sunverge also offer home-energy storage systems, and German startup Sonnen shipped its 10,000th battery system in February 2016, taking on Tesla and claiming a leading position in the global smart energy storage market.[37]

"We're talking about storage as the next solar in terms of rapid efficiency gains and the prices coming down — and when batteries become that pervasive, it will solve a lot of problems."

Bo MacEwan
Renewable Energy Leader
Deloitte Africa

Initial enthusiasm for home energy storage systems aside, energy storage companies today are generally finding the greatest revenue opportunities in providing frequency response capabilities for grid operators, as well as in reducing costs for energy intensive businesses in places where electricity costs are high. Nonetheless, with numerous solutions entering the market and adoption increasing rapidly, some believe that energy storage will take a similar path as solar did in its evolution — only faster, since investors have been down this road before and are more comfortable with the risks. While policymakers are still trying to catch up to the rapid advances in energy storage, they will likely act to create more markets for it, since energy storage technologies on the whole benefit all forms of electricity generation on the grid, not just renewables.

"The beauty about some of this storage technology is that it's modular and scalable — from very small installations to grid-scale."

Felipe Requejo
Global Leader, Power
Deloitte Touche Tohmatsu Limited

What if ...

... critical mass in energy storage is reached sooner than anticipated?

Tesla's Powerwall retails for USD 3,000.[38] Some assert that the true cost is closer to USD 9,600 to 10,150, which includes the battery system itself plus an inverter interface, gateway, reseller margin, installation fee and sales tax.[39] When combined with a rooftop solar installation, consumers in the US, Europe and Australia could potentially lessen their dependence upon the electricity grid, if not cut their ties to it altogether, for about USD 25,000 to 30,000.[40] While still too high for many consumers, this price point is comparable to buying a mid-range car, and thus could be psychologically within reach. If early movers around the world demonstrate the viability of such a system, it might not be long until critical mass is reached and a full-scale "grid independence" movement could be underway.

"So many different business sectors are trying to develop energy storage technology that when it's widely commercialized, it's scale will be bigger than anything we presently envision in the electricity sector."

Elisa Prieto
Strategy Director
Acciona

"Mine sites are ideal for self-generation with renewables, since a lot of the places where mines operate do not have access to low-cost reliable power, or even to power at all."

Russell Blades
Senior Manager — Energy and GHG
Barrick Gold Corporation

#5
Grid integration

Once the nemesis for utilities, a host of new technologies are quickly making integration of intermittent power sources into the electricity grid a problem of the past.

In its 2015 World Energy Outlook, the International Energy Agency quietly made a momentous prediction: "Driven by continued policy support, renewables will account for half of additional global generation, overtaking coal around 2030 to become the largest power source." This bold projection is supported by the tremendous advancements that have been made in integrating renewables into the grid. As little as five years ago, it was widely believed that intermittent sources of electricity generation would threaten grid reliability and stability once they surpassed 10% penetration.

Several countries, states and provinces have now far exceeded that threshold, demonstrating that the limits to renewable integration are much higher than previously thought — if they exist at all. Renewables currently deliver 28% of Germany's total grid power (and up to 40% in some regions).[41] Yet, the nation experiences just 15 minutes a year of outages, compared with significantly higher numbers in other countries.[42] Meanwhile, Hawaii has emerged as the proving ground for grid integration in the US. With some islands now exceeding 20% renewable penetration, Hawaii's electric companies have experienced few reliability issues.[43]

Targeting 100% renewable energy by 2045, the utilities in Hawaii are working in conjunction with the US National Renewable Energy Laboratory to develop mitigation strategies aimed at curtailing reliability problems that may occur at higher rates of solar penetration.

In most places, renewable power sources are nowhere near the current grid integration limits, suggesting there is presently much more room for expansion. Furthermore, those thresholds appear to be continually moving upward. Researchers studying the grid in Germany believe a much higher concentration of renewables, 50% or more, is possible.[44] How? A host of new technologies are making existing electricity grids more flexible, which is key to integrating intermittent power sources. These technologies include:

- Batteries, flywheels, molten salt, pumped hydro and other energy storage mechanisms for time-shifting renewable generation and enhancing frequency response.

- Advanced analytics, which enhance forecasting accuracy (i.e., predicting load on the grid as well as the output of solar and wind installations on a given day).

- Grid-control gear and interconnections that link national systems, allowing power from wind and solar farms to be spread over wider regions.

- Demand response programs, which involve paying commercial, industrial, and even residential customers to reduce electricity demand given advanced notice.

- Smart technologies, which allow two-way communication across the grid, between generators, storage providers, and electricity users, thus enabling more efficient transmission, distribution and load balancing.

However, these technologies come at a cost. For instance, the German Institute for Economic Research in Berlin estimated Germany needs to invest €6.1 billion a year in its grid by the end of this decade to cope with additional wind and solar installations.[45] Considering the enormous annual investments that utilities routinely make in upgrading their transmission and distribution systems, some studies suggest these costs are manageable.

"Control of the grid has greatly improved: We now have the capability to manage electricity flows in different directions, which gives the system operator the ability to manage production and supply in real-time."

Florian Klein
Renewable Energy Lead
Monitor Deloitte Germany

An analysis by the US National Renewable Energy Laboratory, for example, estimates the US grid could absorb as much as 80% of its supplies from renewables by 2050 while keeping investment in transmission within the historical range of USD 2 billion to 9 billion a year.[46]

What if ...

... the growth trajectory of renewables takes the path less traveled?

As developed economies debate the risks and rewards of integrating more renewable power sources into their existing electricity grids, alternative energy momentum is quietly building in areas where there are no grids at all. Today, approximately 1.5 billion people lack access to electricity, mainly in sub-Saharan Africa and Asia.[47] Millions more have access to electricity, but service is unreliable. Microgrids and renewables may offer an answer. Rural electrification models increasingly include solar and diesel-generation hybrid systems, solar systems with batteries, and full-fledged microgrid systems that can integrate a mix of generation sources and offer traditional grid-management capabilities. Much progress in this area is being made, with India deploying dozens of microgrids in its rural states, Nepal adopting micro-grid solutions to power health clinics, and several nations in Africa embracing solar water pump designs and container-based microgrid solutions that don't require special expertise to set up. Technical, logistical and financial hurdles to microgrids plus renewables are still being ironed out. Nonetheless, developments such as these suggest that renewable energy solutions could soon follow a similar trajectory as mobile phones, growing the fastest in areas where solution providers do not have to contend with existing infrastructure.

Conclusion

Critics may argue that the trends presented in the report are decidedly bullish and that the barriers to renewable energy's progress have not been given equal weight. This is largely because we do not see the traditional barriers of cost, intermittency, and grid integration, as being deal-breakers in the long run. Our main take-away in compiling this report is that a confluence of forces is driving renewable energy forward, the collective momentum of which is likely irreversible. While growing pains are inevitable, first-movers such as Denmark, Germany, China, the UK, the US and Spain, have dealt with them, and the results of COP21 suggest that many other nations now believe it is necessary to do so. This is perhaps the greatest indicator that renewable energy has not merely entered the mainstream, but is fast-becoming the norm itself.

How Deloitte can help

Deloitte assists energy and resources companies in staying ahead of developments that could either disrupt their businesses or present important opportunities. Our specialists provide a broad range of multi-disciplinary services, spanning strategic planning, financial structuring and capital raising, mergers and acquisitions, risk management, complex accounting, and advanced analytics, among others. Through these services, we create integrated fit-for-purpose solutions — all to help our clients position themselves to prosper amidst the massive changes that are reshaping the energy industry.

Acknowledgements

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Endnotes

1. "International Energy Outlook 2016," US Energy Information Administration, May 11, 2016, http://www.eia.gov/forecasts/ieo/electricity.cfm
2. International Energy Agency, http://www.iea.org/aboutus/faqs/renewableenergy/, accessed May 18, 2016.
3. "Global Trends in Renewable Energy Investment 2016," Bloomberg New Energy Finance, March 24, 2016, http://about.bnef.com/press-releases/global-trends-in-renewable-energy-investment-2016/
4. Ibid.
5. Ibid.
6. Ibid.
7. Paris climate deal to be signed by over 130 countries at UN ceremony," The Guardian, April 8, 2016, http://www.theguardian.com/environment/2016/apr/08/paris-climate-deal-to-be-signed-by-over-130-countries-at-un-ceremony).
8. Ibid.
9. Ibid.
10. "States' Reactions to EPA Greenhouse Gas Emissions Standards: Final Rule for Future and Existing Power Plants," National Conference of State Legislatures, April 18, 2016 http://www.ncsl.org/research/energy/states-reactions-to-proposed-epa-greenhouse-gas-emissions-standards635333237.aspx
11. Ibid.
12. Alan Neuhauser, "61 Percent of the Public Supports the Clean Power Plan in the states suing to stop it," US News and World Report, November 2, 2015, http://www.usnews.com/news/blogs/data-mine/2015/11/02/61-percent-of-public-supports-clean-power-plan-in-states-suing-to-stop-it
13. "Trudeau, premiers agree to climate plan framework but no specifics on carbon pricing," CBC News, March 3, 2016, http://www.cbc.ca/news/politics/first-ministers-premiers-trudeau-1.3474380.
14. Ibid.
15. Giambusso, David, and Waldman, Scott. "State regulators approve plan to overhaul energy grid," Capital New York, February 27, 2015, http://www.capitalnewyork.com/article/albany/2015/02/8563037/state-regulators-approve-plan-overhaul-energy-grid.
16. "France Decrees New Rooftops Must Be Covered in Plants or Solar Panels," The Guardian, March 19, 2015, http://www.theguardian.com/world/2015/mar/20/france-decrees-new-rooftops-must-be-covered-in-plants-or-solar-panels
17. Camila Domonoske, "San Francisco Requires New Building To Install Solar Panels," National Public Radio, April 20, 2016, http://www.npr.org/sections/thetwo-way/2016/04/20/474969107/san-francisco-requires-new-buildings-to-install-solar-panels
18. "France Decrees New Rooftops Must Be Covered in Plants or Solar Panels," The Guardian, March 19, 2015
19. RE 100 Web Site, accessed May 19, 2016, http://there100.org/
20. RE 100 Web Site, Companies, accessed May 19, 2016, http://there100.org/companies
21. Corporate Renewable Energy Buyers' Principles Web Site, accessed May 19, 2016, http://buyersprinciples.org/
22. Ibid.
23. Company Web Sites
24. Deloitte Resources 2016 Study, Deloitte, http://www2.deloitte.com/us/en/pages/energy-and-resources/articles/resources.html
25. The Deloitte Millennial Survey 2016, Deloitte, http://www2.deloitte.com/global/en/pages/about-deloitte/articles/millennialsurvey.html
26. United States Census Bureau, "Millennials Outnumber Baby Boomers and are Far More Diverse, Census Bureau Reports," wApril 25, 2016, https://www.census.gov/newsroom/press-releases/2015/cb15-113
27. Deloitte Resources 2016 Study
28. United Nations Environment Programme News Centre, Renewable Energy Investments: Major Milestones Reached, New World Record Set, March 24, 2016, http://www.unep.org/newscentre/Default.aspx?DocumentID=27068&ArticleID=36112
29. 2015 Deloitte Alternative Energy Seminar Retrospective
30. International Finance Corporation Web site, accessed May 25, 2016, http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC+Finance/Investor+Information/Green_Bonds
31. Jiang Xueqing, "Green bonds issued for renewable energy," China Daily, February 4, 2016, http://www.chinadaily.com.cn/business/2016-02/04/content_23391522.htm
32. "Electricity Storage: Technologies, impacts and prospects," Deloitte Center for Energy Solutions, September 2015
33. Angelina Rascouet, Francois De Beaupuy, and Anna Hirtenstein, "Total to Buy Battery Maker Saft in Push to Expand Clean Energy," Bloomberg, May 9, 2016, http://www.bloomberg.com/news/articles/2016-05-09/total-to-buy-french-battery-maker-saft-in-1-1-billion-deal
34. Home energy storage is the driving force of the future, claims Tesla trailblazer, The Telegraph, May 15, 2016, http://www.telegraph.co.uk/business/2016/05/15/home-energy-storage-is-the-driving-force-of-the-future-claims-te/
35. Company web site, https://www.teslamotors.com/powerwall.
36. Michael Graham Richard, "Barely a week after Tesla's Powerwall battery was announced, it's sold-out to mid-2016,"May 8, 2015, http://www.treehugger.com/clean-technology/week-after-teslas-powerwall-battery-announced-sold-out-mid-2016.html
37. Julia Pyper, "Sonnen Ships its 10,000th Battery, Putting Pressure on Tesla and Utilities," Greentechmedia, February 17, 2016, http://www.greentechmedia.com/articles/read/sonnen-ships-its-10000th-battery-putting-pressure-on-tesla-and-utilities; and Jason Deign, "Is the luster of Tesla's Powerwall already fading," Greentechmedia, April 18, 2016, http://www.greentechmedia.com/articles/read/is-teslas-powerwall-luster-already-fading
38. Jason Deign, "Is the luster of Tesla's Powerwall already fading," Greentechmedia, April 18, 2016, http://www.greentechmedia.com/articles/read/is-teslas-powerwall-luster-already-fading
39. Ibid.
40. Ibid, and "Complete Solar Panel Cost Guide," Solar Power Advice, accessed May, 24, 2016, http://www.solarpanelscostguide.com/
41. Stefan Nicola and Reed Landberg, "Germany Proves Life with Less Fossil Fuel Getting Easier," Bloomberg, April 13, 2015, http://www.bloomberg.com/news/articles/2015-04-12/germany-proves-life-with-less-fossil-fuel-getting-easier
42. Ibid.
43. Jake Richardson, "100% Renewable Energy Goal for Hawaii, Governor Signs Bill," CleanTechnica, June 11, 2015, http://cleantechnica.com/2015/06/11/100-renewable-energy-goal-hawaii-governor-signs-bill/; SEIA, http://www.seia.org/research-resources/hawaii-solar-integration-study-shows-grid-reliability-high-penetration-rates; and NREL, Hawaii Solar Integration Study.
44. Stefan Nicola and Reed Landberg, "Germany Proves Life with Less Fossil Fuel Getting Easier," Bloomberg
45. Ibid.
46. Ibid.
47. Jay Giri, Rural Electrification Microgrids and Renewables, Institute for Electrical and Electronics Engineers Newsletter, May 2015, http://smartgrid.ieee.org/newsletters/may-2015/rural-electrification-microgrids-and-renewables

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