

Fourth Quarter 2018

Quote of the Quarter:

“Sustainable, responsible and impact investing (SRI) in the United States continues to expand at a healthy pace. Total US-domiciled assets under management (AUM) using SRI strategies grew from \$8.7 trillion at the start of 2016 to \$12.0 trillion at the start of 2018, a 38 percent increase. This represents 26 percent—or 1 in 4 dollars—of the total US assets under professional management.”

[US SIF's 2018 Report on
US Sustainable,
Responsible and Impact
Investing Trends](#)

Overview

- The world is changing rapidly
- Good news for impact private equity across so many fronts
- Wind and solar power is now at 5 cents/kWh!
- Energy storage is the next wave of infrastructure
- Warning: China is ascendant

The World is Changing Rapidly

There is so much to talk about right now and so little time given the normal yearend rush. The pace of technological change is rapid—so rapid it takes considerable effort to keep up. Humanity is making big leaps forward in science, technology, healthcare, food, water and transportation. Just last week we learned of a simple 10 minute blood test to detect cancer at a very early stage (thanks Australia) and that commercial space tourism is here (thanks Richard Branson). We also learned that Porsche, Audi and Jaguar have viable and attractive electric vehicles that can compete with Tesla, Nissan, Toyota and GM, bringing EVs further into the mainstream. Even Harley Davidson is working on an electric motorcycle. There is also so much good news that has yet to be widely reported—further developments in artificial intelligence and agriculture and further cost reductions in energy generation and storage. One of our favorite sayings is that the rate of technological change right now is likely the slowest it will be in our lifetimes. So buckle up.

Impact Private Equity

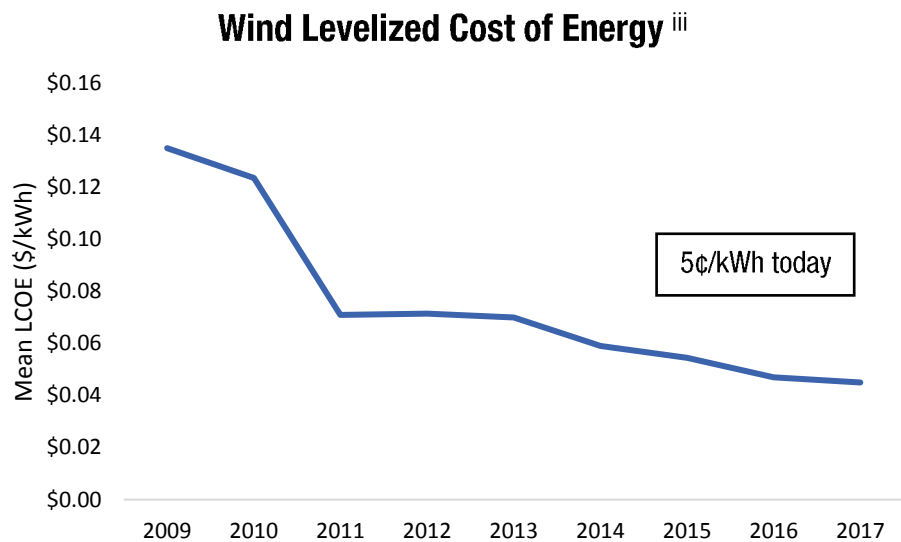
We are very excited about what we are seeing within the impact sectors of private equity right now. Areas of existing investment and possible future investment include: LED lighting and seed hybridization for indoor agriculture, nutrition, personalized medicine, wastewater treatment, renewable energy, energy storage, robotics/automation, sustainable housing, poverty alleviation and the electrification of transportation.

Our first two impact secondaries funds are now fully invested and have net IRRs of 15% and 97% (Clean Growth III and IV, respectively).

Wind and Solar Infrastructure

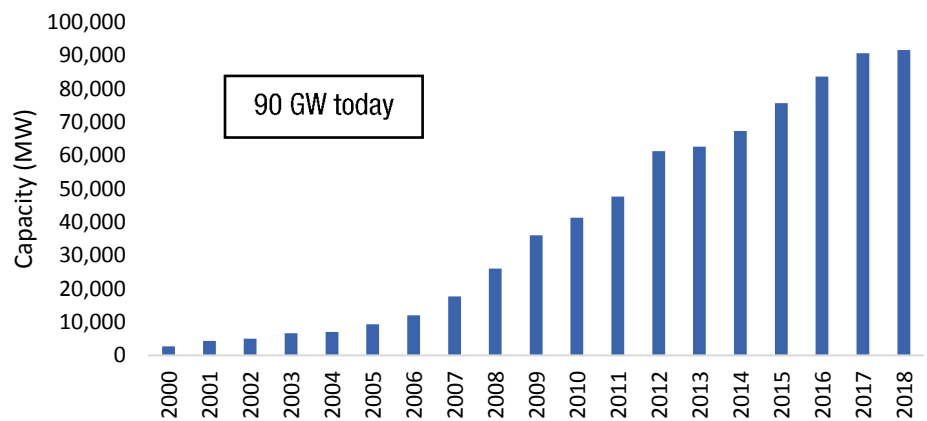
There is a tremendous amount of activity in the construction of wind and solar right now. Wind and solar energy generation are cost-competitive and compelling throughout most of the United States (and much of the rest of the world). **Utility-scale wind and solar electricity production is now often about 5 cents/kWh!** As one frame of reference, we pay about 11 cents/kWh for electricity provided to us by Xcel Energy here in Minnesota. Solar is particularly compelling given that it is easy to install, has no moving parts, requires very little maintenance and has a life expectancy of 25+ years in most cases. Additional exciting advancements were made this year using Perovskite, which is an element that has a higher theoretical maximum efficiency than today's silicon solar panels (roughly 44% efficiency for Perovskite vs 33% for silicon).ⁱ Since 2013, solar power has ranked either first or second in terms of new energy generation installed in the U.S. among natural gas, wind, coal and other forms of power generation.ⁱⁱ

Wind costs became cost-competitive in 2010-11, thanks mostly to advancements in wind blade technology and tower designs that enabled taller towers (i.e., more swept area and captured wind energy).



Over 90 GWs of wind power has been installed in the U.S., including over 1 GW in 1H 2018.^{iv} Total installed U.S. wind capacity is expected to increase by approximately 40% over the next five years.^v

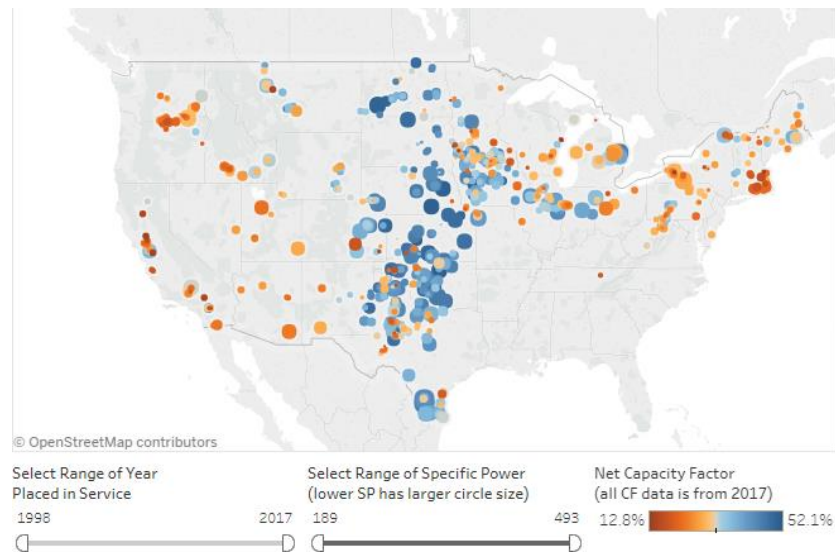
Cumulative U.S. Wind Capacity ^{vi}



The location of wind project installations have been driven by:

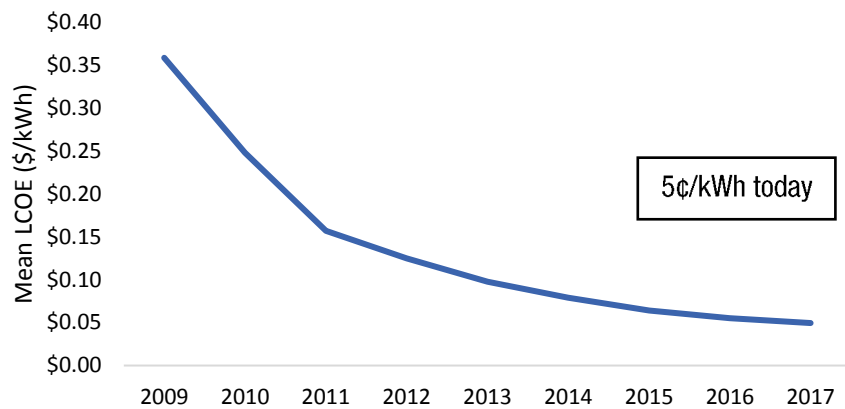
- Accessible land for development
- Wind resources and topography favors states in the Great Plains region
- Lower population density, minimizing NIMBY issues
- State specific mandates requiring renewable energy procurement for resource planning purposes

U.S. Wind Turbine Locations ^{vii}



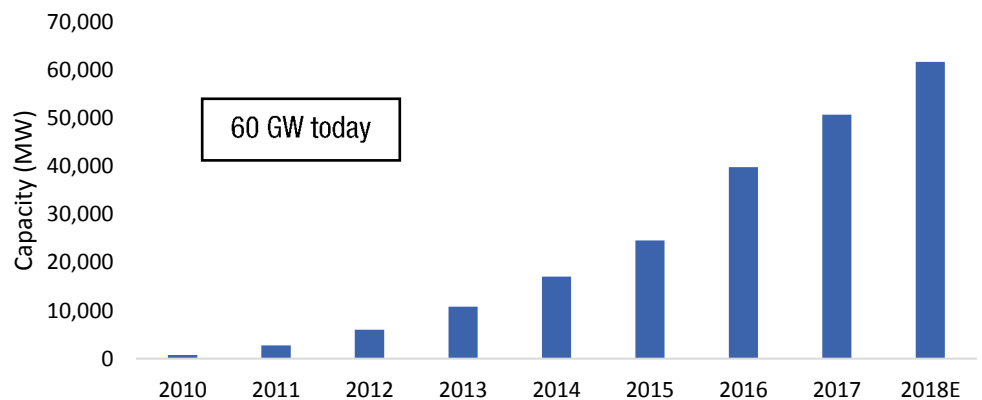
Solar costs have been rapidly declining thanks to economies of scale and in 2014-15 became cheaper than electricity provided by many local utilities.

Solar Levelized Cost of Energy ^{viii}



There has been nearly 60 GW of solar installed in the U.S., including nearly 5 GW in 1H 2018.^{ix} Total installed U.S. solar capacity is expected to more than double over the next five years.^x

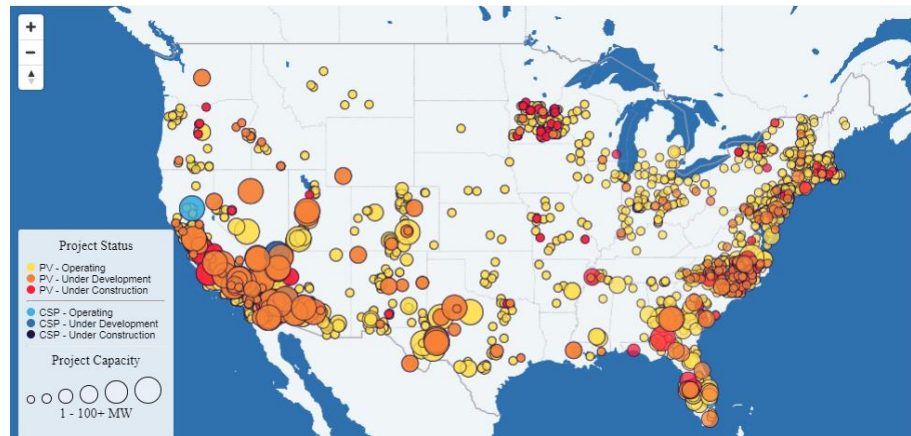
Cumulative U.S. Solar Capacity ^{xi}



The location of solar project installations have been driven by:

- State specific mandates requiring solar procurement for resource planning purposes
- State-level incentive programs to spur demand for solar (e.g., New Jersey Solar Renewable Energy Certificates)
- Favorable climate for solar production
- Favorable real estate resources including low cost of land, availability of land and opportunity for rooftop solar development

U.S. Solar Project Locations^{xii}



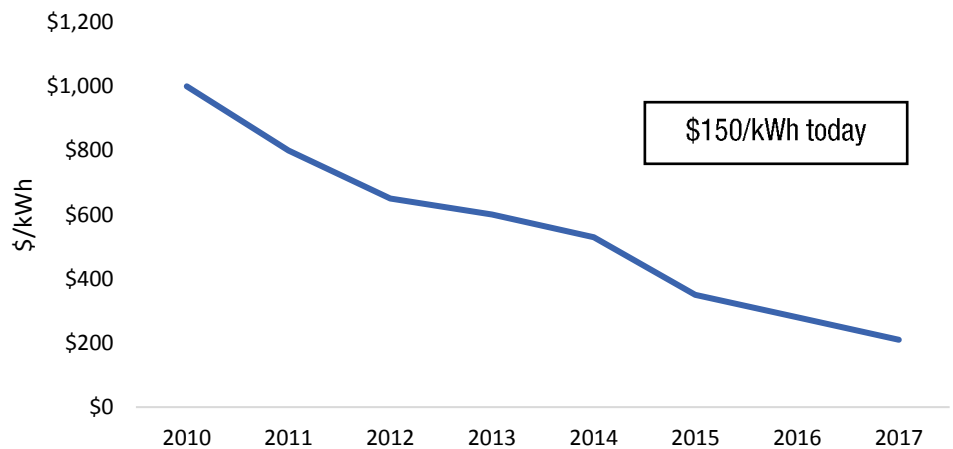
Energy Storage

Energy storage technology is running down two paths: (1) light weight and energy dense for mobile use (cars, buses, scooters and forklifts) and (2) robust for grid storage. Mobile uses are generally lithium-ion (Tesla) or zinc-nickel (forklifts) but advancements are being made in light, cheap, energy dense alternatives like lithium-air technology and solid-state batteries. Stationary grid storage batteries tend to be flow batteries, which are quite heavy in comparison to lithium batteries, or pumped hydro systems. Here again advancements are being made in cheap, efficient and robust batteries that can withstand thousands of charging/discharging cycles and can be used for satisfying peak load demands as well as base load power. Most of these emerging grid-storage batteries will still be heavy but that is irrelevant if they will be sitting on a concrete slab next to a power plant.

Historically, residential solar power systems that incorporated energy storage would use lead-acid batteries, but a major transition is underway as leading companies continue to improve the cost and appeal of their lithium-ion battery systems (Tesla, LG Chem, Sonnen and various Chinese companies).

According to our friend Gerard Reid at Alexa Capital, battery pack prices have fallen rapidly in recent years, **dropping from \$1,000/kWh to about \$150/kWh today and likely \$100/kWh within a year or two.** At \$100/kWh, electric vehicles (EVs) are at cost parity with internal combustion engine (ICE) vehicles before factoring in the much lower costs of driving and maintaining an EV over the life of the car. Note, ICE powertrains have about 1,400 components including many moving parts; EVs have just 200 components with few moving parts.^{xiii} EVs are going to rapidly gain market share soon and are expected to be 50% of the automobile market in 2025 and 70% of it in 2030.^{xiv}

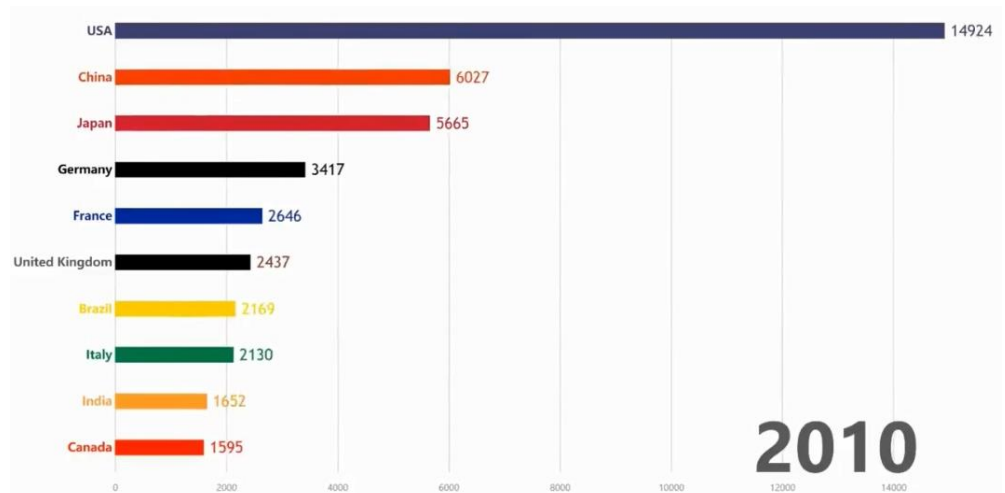
Battery Pack Price ^{xv}



The Danger China Poses and a Call for Unity in the U.S. and Europe

In 2010, China's economy passed Japan's to become the world's second largest.^{xvi}

World GDP by Country in Billions USD ^{xvii}



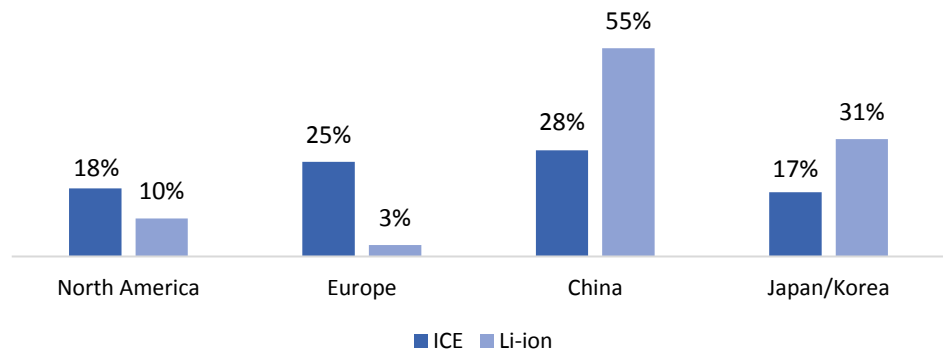
At current GDP growth rates, China will pass the U.S. to become the world's largest economy by 2035.^{xviii} China has already begun to stake its claim to global economic leadership and rewrite the prevailing Bretton Woods international system in its own image by creating the Asia Infrastructure Investment Bank and launching the ambitious "One Belt, One Road" initiative.^{xix}

In our industry, however, China already is ascendant. Starting in the mid-2000s, China has deliberately focused on developing (and/or stealing) the technology and manufacturing capabilities for solar panels, EVs and batteries. During the Great Recession, the Chinese government turned solar panel manufacturing into a jobs program, collapsing global panel prices by 80%, driving many Western manufacturers out of business (e.g., Miasolé, Konarka and Solyndra) and establishing the Chinese solar panel manufacturing industry as the dominant player in the market.^{xx,xxi} Today, 2.5 million people work in China's solar sector versus about 260,000 people in the U.S.^{xxii}

At the same time, China has also rolled out massive and continuing investment in new renewable power generation capacity, and Beijing is now seeking to produce 35% of its energy needs from renewable sources by 2030.^{xxiii} China already claims to have 130 GW of installed solar capacity and expects to reach 250 GW by 2020!^{xxiv} Compare that with about 60 GW of installed solar capacity in the U.S. and about 116 GW in Europe.^{xxv, xxvi} Similar trends are evident in wind, where China modestly lags behind Europe with 167 GW of installed capacity versus about 169 GW in Europe, but significantly leads the U.S., which has about 90 GW currently installed.^{xxvii, xxviii, xxix}

From where we sit, China stands poised to dominate the world's imminent transition from a fossil-fuel-centric economy to an electricity-centric economy, becoming the world's first "clean energy superpower" in the process.^{xxx} By one measure, 60 of the top 200 cleantech companies are already domiciled in China (inclusive of the Hong Kong SAR), versus 34 in the U.S.^{xxxi} Chinese car manufacturers dominate the EV market, currently accounting for more than half of global production.^{xxxii} Below is a very telling graphic showing who controls the past and who is poised to control the future. The CEOs of Tesla, BMW, GM, GE, Siemens, LG Chem and Panasonic certainly know what this chart foreshadows.

Market Share in Global Production of ICE Engines and Li-Ion Batteries ^{xxxiii}



All is not lost, however, and it's not too late for the U.S. and its allies to play catch up. Energy storage is one bright spot, where the U.S., Australia and Germany currently lead the global market, even if China is making rapid strides to close the gap.^{xxxiv} But we need further domestic investment in the cleantech sector, including R&D, manufacturing, and distribution of new technologies and products. We also need to deploy more clean energy infrastructure, including renewable power generation, energy storage and energy efficiency systems. China's cleantech and clean energy industries benefit from IP theft, forced IP transfers from foreign corporations, government support and patronage, but we have a system based on the rule of law that encourages innovation and entrepreneurship in partnership with private capital. We encourage Democrats and Republicans in Washington to set aside their differences to demand in unison that China stop its theft and open its markets to foreign competition. We also call on the private sector to increase investment in cleantech and clean energy. Furthermore Congress should pass a bipartisan infrastructure spending bill to repair our crumbling infrastructure and advance our economy into this new electrified era.

If you want to increase your allocation to impact investments and/or clean energy infrastructure, or are thinking of [taking the first step](#), we encourage you to reach out to start a conversation with us in 2019.

Happy New Year from all of us at North Sky Capital!

Upcoming Events

We are regular speakers and attendees at key industry conferences. We hope to see you at these upcoming events:

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|-------------|---|
| February 11 | SOCAP 365 , Seattle, WA
socialcapitalmarkets.net/socap365/ |
| February 14 | Renewable Energy Forum , London
altassets.net/renewables/ |
| March 4-6 | Confluence Philanthropy 9th Annual Meeting , New York, NY
confluencephilanthropy.org/ |

North Sky Capital Contacts

Scott Barrington
Managing Director and CEO
(612) 435-7170
sbarrington@northskycapital.com

Danny Zouber
Managing Director
(612) 435-7180
dzouber@northskycapital.com

Michael Pohlen
Managing Director
(612) 435-7190
mpohlen@northskycapital.com

Gretchen Postula
Head of Investor Relations
(612) 435-7177
gpostula@northskycapital.com

Andrew Harris
Principal
(646) 708-5769
aharris@northskycapital.com

Tom Jorgensen
Principal
(612) 435-7158
tjorgensen@northskycapital.com

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- ⁱ <https://www.pv-magazine.com/2018/10/17/solar-panel-theoretical-efficiency-limit-increases-by-33>
- ⁱⁱ <https://www.seia.org/solar-industry-research-data>
- ⁱⁱⁱ Lazard's Levelized Cost of Energy Analysis - Version 11.0
- ^{iv} AWEA's U.S. Wind Industry Third Quarter 2018 Market Report
- ^v EIA's Annual Energy Outlook 2018
- ^{vi} <https://www.awea.org/wind-101/basics-of-wind-energy/wind-facts-at-a-glance>
- ^{vii} <https://windexchange.energy.gov/maps-data/333>
- ^{viii} Lazard's Levelized Cost of Energy Analysis - Version 11.0
- ^{ix} SEIA's Solar Market Insight Report 2018 Q3
- ^x SEIA's Solar Market Insight Report 2018 Q3
- ^{xi} SEIA's Solar Market Insight Report 2018 Q3
- ^{xii} <https://www.seia.org/research-resources/major-solar-projects-list>
- ^{xiii} Alexa Capital / PWC
- ^{xiv} Schaeffler Group Press Releases
- ^{xv} Alexa Capital
- ^{xvi} <https://www.nytimes.com/2010/08/16/business/global/16yuan.html>
- ^{xvii} <https://www.visualcapitalist.com/animation-the-worlds-10-largest-economies-by-gdp-1960-today/>
- ^{xviii} <https://www.bloomberg.com/graphics/2016-us-vs-china-economy/>
- ^{xix} <https://www.nytimes.com/2015/12/05/business/international/china-creates-an-asian-bank-as-the-us-stands-alooof.html>, <https://www.brookings.edu/research/chinas-rise-as-a-regional-and-global-power-the-aiib-and-the-one-belt-one-road/>
- ^{xx} <https://www.scientificamerican.com/article/why-china-is-dominating-the-solar-industry/>
- ^{xxi} <https://www.pv-tech.org/editors-blog/biggest-corporate-implosion-in-us-solar-history-the-rise-and-fall-of-sunedi>
- ^{xxii} <https://money.cnn.com/2017/07/18/technology/china-us-clean-energy-solar-farm/index.html>
- ^{xxiii} <https://cleantechnica.com/2018/09/27/china-proposes-75-increase-to-2030-renewable-energy-target/>
- ^{xxiv} <https://www.pv-magazine.com/2018/01/22/chinas-cumulative-pv-capacity-hits-130-gw-to-reach-250-gw-by-2020/>
- ^{xxv} <https://www.seia.org/us-solar-market-insight>
- ^{xxvi} <https://www.greentechmedia.com/articles/read/solar-broke-records-all-over-europe-this-summer#gs.J16lSgc>
- ^{xxvii} <https://www.asiapacific.ca/blog/chinas-clean-tech-commitment>
- ^{xxviii} <https://windeurope.org/about-wind/statistics/european/wind-in-power-2017/>
- ^{xxix} AWEA's U.S. Wind Industry Third Quarter 2018 Market Report
- ^{xxx} <https://www.brookings.edu/blog/techtank/2018/11/27/chinas-belt-and-road-initiative-is-poised-to-transform-the-clean-energy-industry/>
- ^{xxxi} <https://www.asyousow.org/report/clean200-2018-q3>
- ^{xxxii} <https://www.asiapacific.ca/blog/chinas-clean-tech-commitment>
- ^{xxxiii} Alexa Capital / Roland Berger
- ^{xxxiv} <https://www.greentechmedia.com/articles/read/us-leads-global-storage-development-but-chinas-catching-up#gs.7fFRYP0>

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