Renewable Energy: Update, Politics, and Investment Opportunities

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Renewables are Rapidly Replacing Fossil Fuels

**Installed Operating Generating Capacity**
- Renewables (wind, solar, biomass, and geothermal) accounted for only ~11% of installed operating generating capacity in the U.S. as of December 2017

**Replacement of Fossil Fuels by Renewables**
- Renewables accounted for ~57% of all U.S. new installed capacity from 2015 – 2017

**Growth of Solar**
- Installations in 2017 down from a record 15 GW in 2016; despite that, 73% CAGR in capacity since 2011

**Growth of Wind**
- Wind capacity has increased twenty-fold since 2001

Renewable Energy Capacity Built, by Technology

Source: Bloomberg New Energy Finance; Business Council for Sustainable Energy
Solar Costs Continue to Fall

Falling Cost of Solar Systems and Rising Retail Rates

Declining Costs to Deliver Projects Globally

Price Benchmark for Fixed-axis, Utility-scale PV Systems (real 2016 US$/W)
Wind Energy Costs Are Falling

- Bigger, taller turbines
- Improved technology and efficiency
- Lower costs – manufacturing economies
Renewables are Cost Competitive: LCOE Unsubsidized

- Solar is now cheaper than coal on a levelized cost of energy (LCOE) basis: $54/MWh vs. $66/MWh. Solar costs continue to fall.
- Onshore wind benchmark is “tied” with CCGT, but with strong wind resources can achieve LCOEs as low as $33/MWh, even cheaper than natural gas ($49/MWh).

Corporate Procurement of Renewable Energy

Renewable capacity contracted by corporations, 2017

Largest corporate offtakers, 2017

- **Apple** contracted 560MW of renewable energy in 2017, more than any other corporation. It signed the largest PPA ever between a corporation and a utility – a 235MW PV plant with NV Energy under the utility’s GreenEnergy Rider.

- **Google** signed PPAs for 536MW, to offset 100% of its global electricity demand. Kimberly-Clark, T-Mobile, General Mills and Cummins all signed their first PPAs in 2017.

- **RE100**: Corporations pledging to reach 100% renewable energy. Notable names: Ikea, Adobe, BofA, BMW, Bloomberg, Burberry, Citi, Coca-Cola, ClifBar, Danone, Ebay, Facebook, GM, Goldman Sachs, Google, HP, J&J, JPM, Kellogg, LEGO, Mars, Microsoft, Morgan Stanley, Nestle, Nike, P&G, Starbucks, Visa, Walmart, etc.

Corporate Renewable Energy Users, Largest by State

Walmart: 6
Target: 6
IKEA: 6
Amazon: 4
Google: 4

Source: David Gardner and Associates, April 2017
First US Offshore Wind Project – Block Island

Deepwater Wind is ready to apply for state and federal permits to build what could be the nation’s first offshore wind farm and hopes to start generating power in 2014. Just 10 percent of the electricity would power all of Block Island’s needs, with the rest entering the grid in Rhode Island.

Five turbines are placed 1/2 mile apart in water 75-80 feet deep. Turbine tower height: 650 feet. Width of turbine blades: 500 feet.
More Offshore Wind Projects Coming

• “South Fork”, LI, selling to LIPA (developed by Deepwater Wind)
• 90MW, 30 mi east of Montauk, connecting at East Hampton
• NJ: New Gov. Murphy reversed Gov. Christie’s stance, calling for 3.5GW by 2030
• NY Masterplan: 800MW by 2020; 2.4GW by 2030;
• MA: goal of 1.6GW by 2027
• Significant economic activity on land, revitalizing ports (Quonset Point, RI)
Hywind Scotland
The world's first commercial floating wind farm

Rotor diameter: 154 metres
Blades: Length 75 metres
Each turbine weighs 12,000 tonnes

Suction anchors: 15 suction anchors, 16 metres tall, 5 metres in diameter and weighing approx. 300 tonnes each.

Turbine height: 253 metres in total, 78 metres below sea surface, 175 from sea surface to wingtip.

Chains: 2,400 metres long, weighing 1,200 tonnes

Hywind Scotland consist of 5 turbines, 6 MW each -> 30 MW
Will supply with renewable energy 20,000 UK households

Masdar
A MUSADABA COMPANY
Statoil

In a deal between the Scottish government and Norwegian oil company Statoil, five wind turbines with a capacity of 6 megawatts each will be set on floating structures some 15 miles off the northeast coast of Scotland near Peterhead. The £228 million Hywind Scotland project will generate enough power for 20,000 homes with operations expected to start in late 2017.

Inertial Suction Anchor (ISA) system. The ISA is a semi-sub structure made of steel jacket filled with ballast. The jacket can be located in water depths ranging from 104 ft to 2,300 ft.

Floating structure made of steel jacket filled with ballast. The Hywind turbines will share infrastructure such as power cables and transmission facilities.

Source: Statoil Hywind

STAFF GRAPHIC: MICHAEL FISHER
Texas CREZ – Captured Stranded Wind

Cost: $8 billion
Distance: 3600 miles
Capacity: 18.5 GW
Completed: 2014
Other Baseload Renewable Energy Sources

- **Hydropower**
  - Now 9% of load; few new being built
  - Environmental impact

- **Geothermal**
  - Tapping subsurface heat to generate electricity
  - Mostly in West; base load; small contributor

- **Combustion or gasification of organic materials**
  - Wood-burning power plants (incl. pelletized wood as coal substitute)
  - Forest management; pine beetle in West/Canada

- **Waste to Energy (many types)**
  - Methane capture (and pipeline injection, or fuel generator)
    - Anaerobic Digestion (manure, food waste, etc.)
    - Landfill gas
  - MSW/RDF processed to various fuel forms
Politics: Federal Tax Incentives - Supporting Renewables

- **Wind:**
  - 2.3c/kWh production tax credit (PTC)
  - Since 1992 (escalated with inflation)

- **Solar:**
  - 30% investment tax credit (ITC)
  - Since 2005

- Benefit: attracted large cash investors (~40% of project cost) into generation projects, who received tax shelter in lieu of cash. (JPMorgan Chase has been a large US “tax investor”.)

- Extended in 2015 for 4 years, phasing out by 2021

- Early House versions of the Tax Cut and Jobs Act of Dec 2017 included changes to the phase-out, but it was ultimately left intact.
Tariffs on Imported Solar Cells and Modules

- 4-year tariff on imported PV solar cells and modules, from all countries
- Consensus: a minor, temporary, politically-motivated cost increase for the solar industry
- Tariff Schedule over 4 years: 30%, 25%, 20%, 15%
  - First 2.5GW of imports each year are exempt from tariffs (~20% of imports)
  - Many developers have stockpiled components for the next 1-2 years
- Increases solar TOTAL installation costs by ~5-10% (as cells/modules are a fraction of the costs)
- Tariff is MUCH lower than plaintiffs requested (their ask would have doubled the cost)
- Only 1000 people employed in manufacturing solar cells/modules vs. ~250,000 in total US solar (installers, services, etc.)
- Hurts the larger installation businesses more than helped the small US manufacturing businesses
- Will it bring jobs? TBD: Days later, Jinko Solar (China) announced a $410mm deal with Jacksonville FL to build a factory there.

Source: GTM Research, Bloomberg New Energy Finance
State Policies Driving Renewables Adoption

State Renewable Portfolio Standards (RPS)

Through 2025, RPS will drive new capacity for 189,800 GWh of renewable energy

- WA: 15% x 2020*
- OR: 50% x 2040* (large utilities)
- CA: 50% x 2030
- NV: 25% x 2025*
- AZ: 15% x 2025*
- NM: 20% x 2020 (IOUs)
- CO: 30% by 2020 (IOUs) **
- UT: 20% x 2025†
- MT: 15% x 2015
- ND: 10% x 2015
- SD: 10% x 2015
- IA: 105 MW
- MN: 26.5% x 2025 (IOUs)
- IL: 25% x 2026
- MO: 15% x 2021†
- WI: 10% x 2015
- IN: 10% x 2026
- MI: 15% x 2021‡
- OH: 12.5%
- NC: 12.5% x 2021 (IOUs)
- TX: 5,880 MW x 2015*
- OK: 15% x 2015
- KY: 2025†
- KY: 2025†
- SC: 2% 2021
- DC: 50% x 2032
- ME: 40% x 2017
- NH: 24.8 x 2025
- VT: 75% x 2032
- MA: 15% x 2020 (new resources)
- 6.03% x 2016 (existing resources)
- RI: 38.5% x 2035
- CT: 27% x 2020
- NJ: 20.38% RE x 2020 + 4.1% solar by 2027
- PA: 18% x 2021†
- DE: 25% x 2026†
- MD: 25% x 2020
- DC: 50% x 2032

29 States + DC have RPS (8 states have goals)
Other State/Local Programs

• Net energy metering (NEM)
  • Encourages rooftop/distributed solar
  • Consumers can effectively sell power back to utility at retail/wholesale rate
  • “Behind the meter” – meter runs backward if generation > consumption
  • Mandatory in 38 states + DC
  • +9 states either allow NEM, or have related rules

• Community Solar in 16 states
  • Facilitates larger projects; subscribers enjoy bill credits (like NEM)

• Targeted incentives/mandates – push state goal/problem
  • Solar
  • Offshore wind
  • CA - dairy manure
  • NC - swine manure

• Carbon Tax: WA legislation introduced, but not passed

• Cap and Trade
  • CA – only state with its own
  • RGGI – regional states’ alliance
  • Western Climate Initiative – regional states’ alliance
Regional Cap and Trade Alliances

U.S. Regional Cap-and-Trade Programs

Light-colored states in each region are program observers.
Clean Power Plan (Obama’s GHG reduction targets for each state)
- Not being implemented by EPA
- Renewables grew rapidly without it
- Many states looking medium/long term, and reducing GHG anyway
- Opportunity loss: removes some pressure, impetus, urgency
- Federal vacuum is rousing/energizing state activists

COP21 (Paris Accord)
- US announced withdrawal
- US cannot withdraw until Nov 2020
- Sparked the formation of the US Climate Alliance, 16 states pledging to meet the goals of COP21 and Climate Action Plan
- Sparked the formation of “America’s Pledge” and “We Are Still In,” initiatives led and financed by Michael Bloomberg to represent American states, cities, businesses, and universities (over 1/3 of population/GDP) in fulfilling COP21, in lieu of the Federal Government.
  - Bloomberg Foundation replaced the $15mm US contribution to the UN, and will finance the reporting requirement.
  - Michael Bloomberg appointed UN Special Envoy for Climate Action
Integration: Renewables, EV, and Battery Storage
Battery Storage is Here, Growing, Getting Cheaper

Tesla Gigafactory in NV - $5bn, 5.5mm sf, JV with Panasonic, 6500 jobs; 150 GWh/yr

Tesla building a 129 mWh battery in Australia (3x next largest)
Electric Vehicle Adoption is Fast Growing

US: 2016 – 159k (0.9% US car sales)
US: 2017 – 200k (1.2% US car sales) up 26%
CA: from 10,000 EV to 300,000 EV in 5 yrs
CA target: 1.5mm EV by 2015; 5mm EV by 2030
CA: 15,000 EV chargers now; need 250,000 by 2025;
SCE/PG&E/SDG&E asking for $1bn over 5yrs in rate base
Summary - Types of Investment Opportunities

- **Overall**
  - Many start-ups, optimistic forecasts; new management teams
  - Volatile, faddish, competitive, missed targets

- **Developer Public Equity**
  - A few public, including some Canadian; several ETFs
  - Most are private, PE/infra fund backed

- **Manufacturers/Installers Public Equity**
  - Competitive, commoditized
  - Chinese/US PV mfgrs; EU/US/Chinese wind mfgrs; US installers; GE/Siemens

- **Yieldco Public Equity**
  - Building a portfolio of cash-generating assets – market became competitive, stock prices fell, and it became harder to find accretive investments
  - A few successes, others languished, or were distress-sold to private equity.

- **Private Equity Investments**
  - Via funds and fund co-investments – equity/infra (primarily institutional)
  - Examples: Blackrock, LS, DESRI, GIP (a few pure RE, many mixed energy/infra)

- **Debt**
  - Private debt dominated by banks/insurance companies – direct, not funds
  - Public debt – rare due to non-investment-grade credits
  - Mezzanine debt (2nd lien/holding co. project-based) - via funds
Equity in Developers

- SunEdison (bankrupt)
- Transalta Renewables $1.4bn
- Innergex $1.4bn
- Northland $2.9bn

- Most US developers are private, PE backed.
- Some are integrated with funds.
- Several active/listed in Canada

Illustrations only, not investment recommendations.
Equity in Solar Installers

Vivent

- Competitive
- Hard to differentiate
- Vendor finance driven

Sunrun

Illustrations only, not investment recommendations.
Equity in Yieldcos

Pattern (PEGI $1.7bn)

8point3 ($1.0bn) (sold)

TerraForm Global ($0.9bn) (sold)

Brookfield ($5.5bn)

Nextera Energy Partners ($2bn)

TerraForm Power ($1.7bn) (sold)

A few successful. Many victims of: few accretive assets, market distrust, low stock price, inability to grow. Several sold in distress to PE funds.

Illustrations only, not investment recommendations.
ETFs

Guggenheim Solar ETF

First Trust Global Wind Energy ETF

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Equity in Equipment Manufacturers

SunPower
$1.0bn

FirstSolar
$7.1bn

Canadian Solar
$0.9bn

Hanwha Q Cells
$0.7bn

Jinko Solar
$0.6bn

Vestas
$15bn

Siemens
$109bn
(not pure-play)

Goldwind
$1bn

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