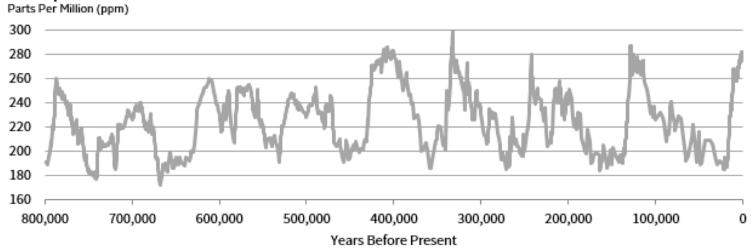
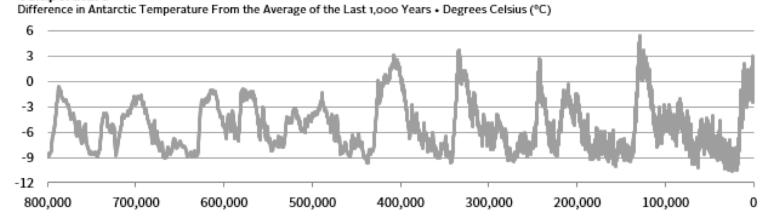
Texas Energy Week February 18, 2020

#### Atmospheric Carbon Dioxide Levels



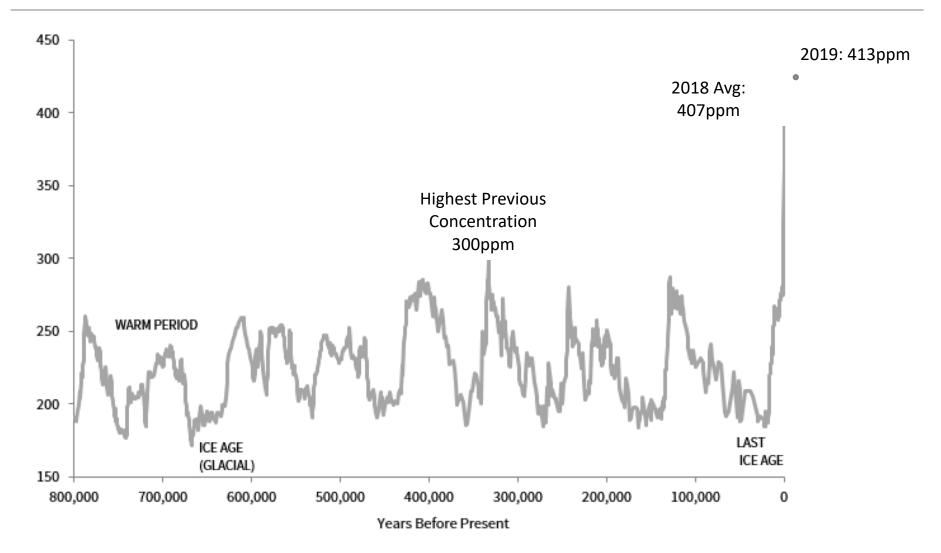
#### Temperature



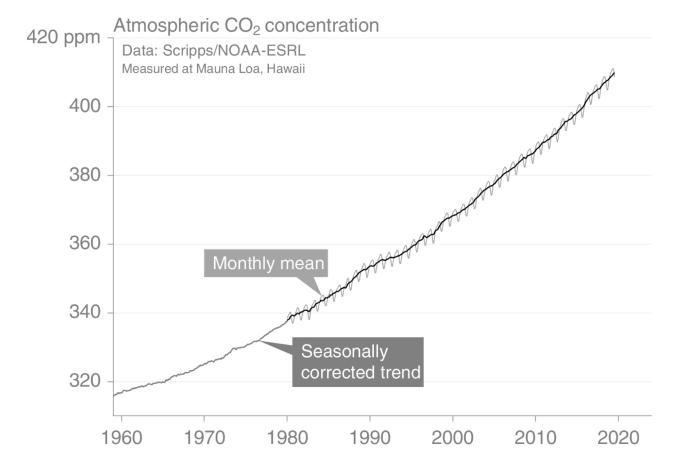
#### CARBON DIOXIDE LEVELS AND TEMPERATURES

Years Before Present

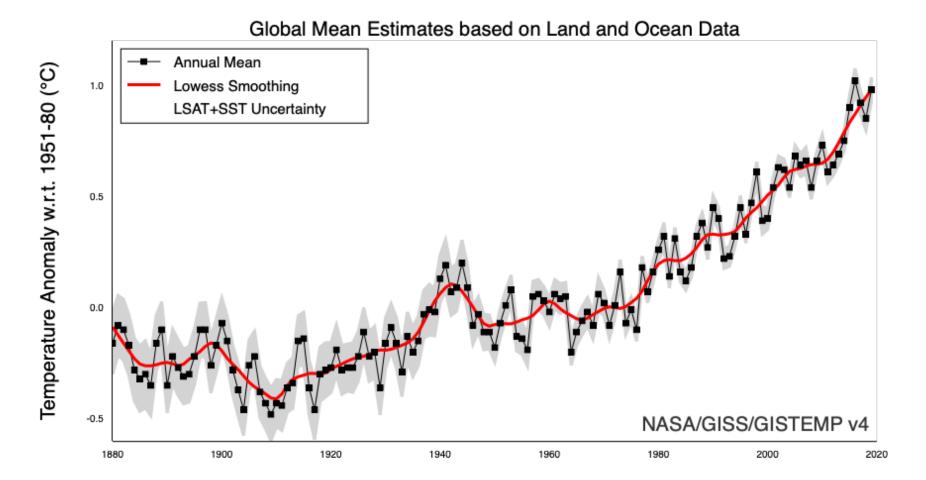
Sources: NCEI, NESDIS, NOAA, US DOC



AVERAGE CARBON DIOXIDE LEVELS OVER THE PAST 800,000 YEARS Parts Per Million (ppm)

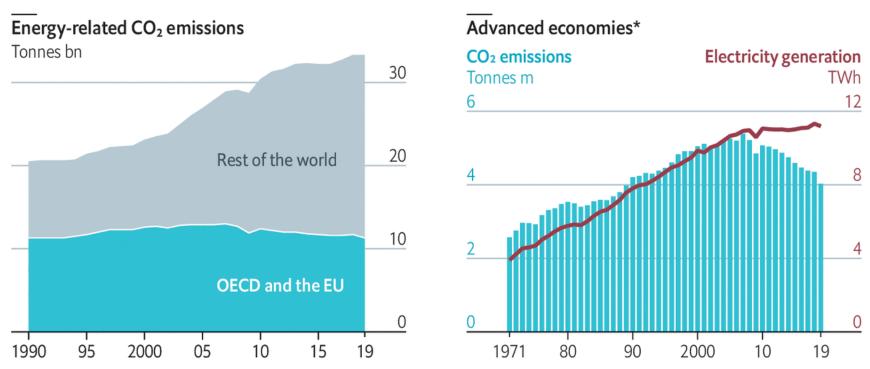


AVERAGE CARBON DIOXIDE LEVELS OVER THE PAST 60 YEARS Parts Per Million (ppm)

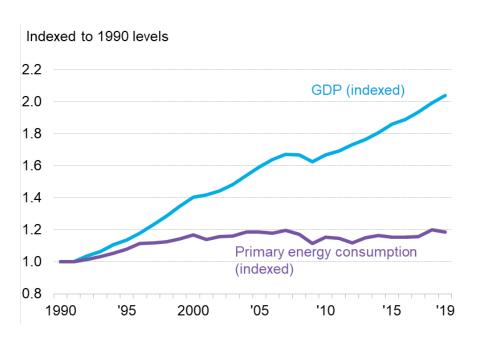


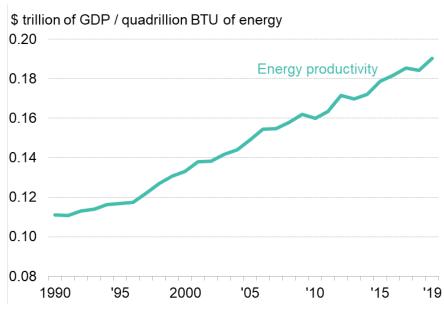
DEVIATION FROM THE GLOBAL MEAN SURFACE TEMPERATURE (ESTIMATES BASED ON LAND AND OCEAN DATA) -- 1880–2018 • (°C)

Sources: NASA Goddard Institute



\*Australia, Canada, Chile, European Union, Iceland, Israel, Japan, South Korea, Mexico, Norway, New Zealand, Switzerland, Turkey and United States

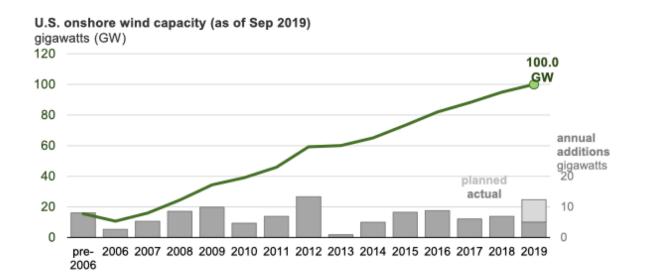


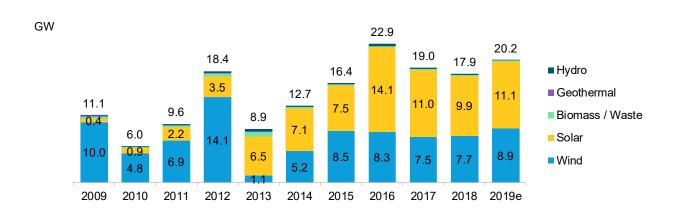


US economy has grown 25% (GDP) over the last decade, while primary energy consumption has risen 6.6%

Since 1990, the US economy has more than doubled in size, while primary energy consumption has grown by just 19% -- an improvement in US energy productivity of 72% over three decades.

Sources:





Almost 150GW of wind and solar was built b/t '10-'19

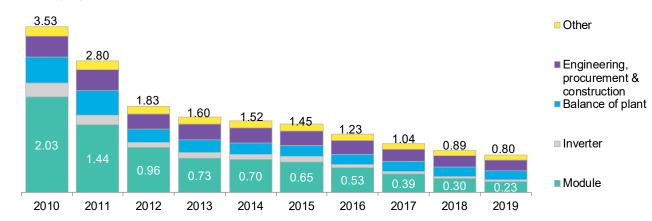
Installed Wind has tripled,

Solar has increased 80X
over the last decade

18% of total US electricity consumption in 2019 was from renewables

Sources: EIA, BNEF

#### 2019 \$/W(DC)



# Key Observations

Module cost are 11% of what they were a decade ago.

Global turbine prices have fallen 58% in that same time period

Warranties have increased by 5 years in that time

Bifacial trends promise additional gains of 4-9%

#### \$m/MW

2009

2010

2011

2012

2013



2014

2015

2016

2017

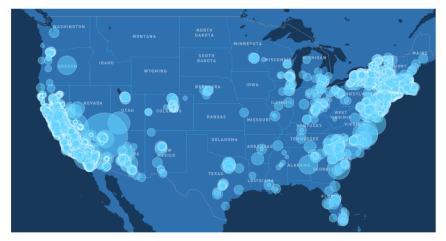
Sources: EIA, BNEF

2019

### 2009 Solar PPAs



2018 Solar PPAs



1	Apple	393.2 (MW)
2	Amazon	329.8
3	Target	242.4
4	Walmart	208.9
5	Switch	179.0
6	Google	142.9
7	Kaiser Permanente	140.0
8	Prologis	126.3
9	Solvay	81.4
10	Fifth Third Bank	80

<sup>&</sup>quot;Ahead of Schedule, Target Hits an Important Climate Goal" - Jan. 6, 2020

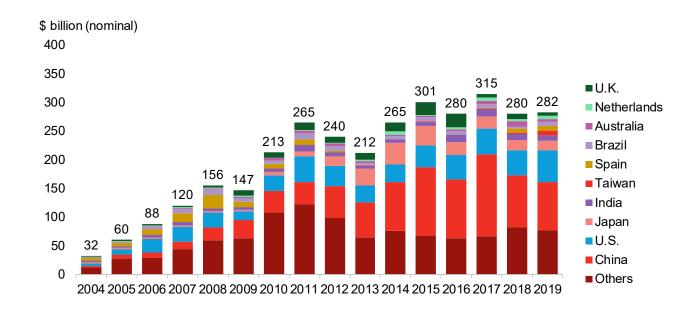
Sources: SEIA

<sup>&</sup>quot;McDonald's USA Signs First-Ever Large-Scale Virtual Power Purchase Agreements (VPPAs)" - Nov. 7, 2019

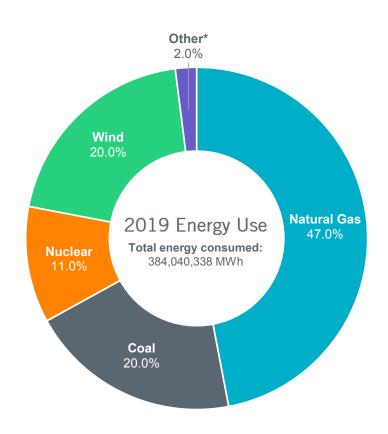
<sup>&</sup>quot;Wells Fargo will power its 400 Texas locations with solar" – Oct. 17 2019

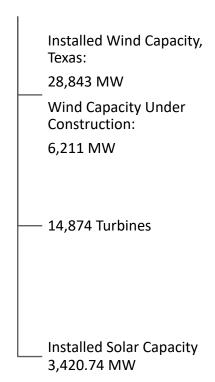
Global Asset finance for clean energy reached \$282 billion in 2019

In the US, clean energy investments set a new high, surging 28% to \$55.5 billion

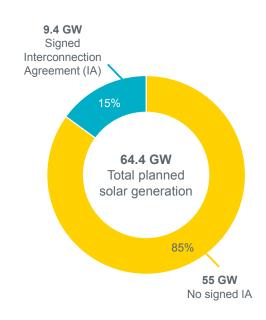


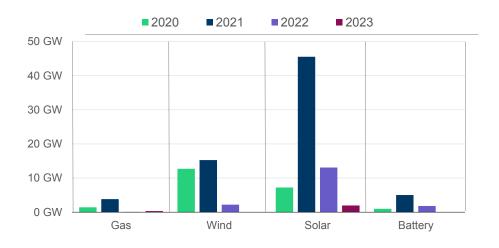
Sources: BNEF, BCSE

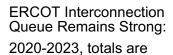


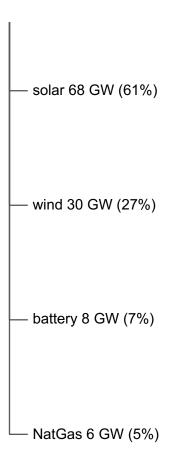


Sources: ERCOT, AWEA

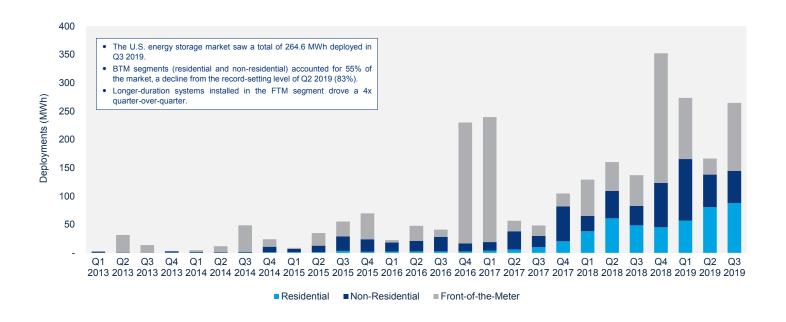


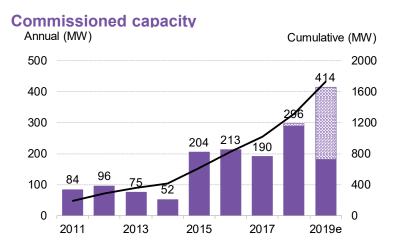


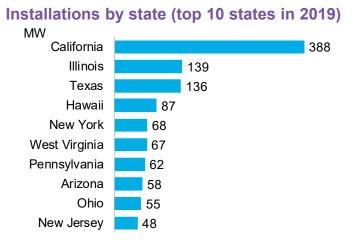




Sources: ERCOT

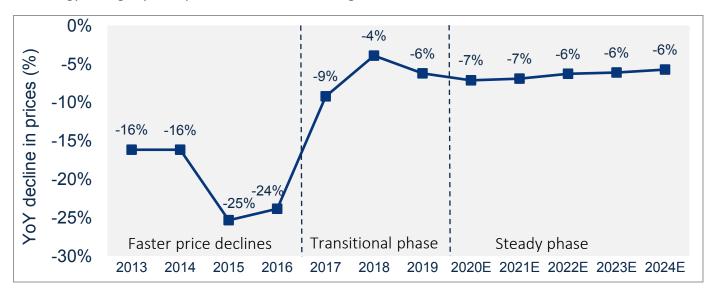


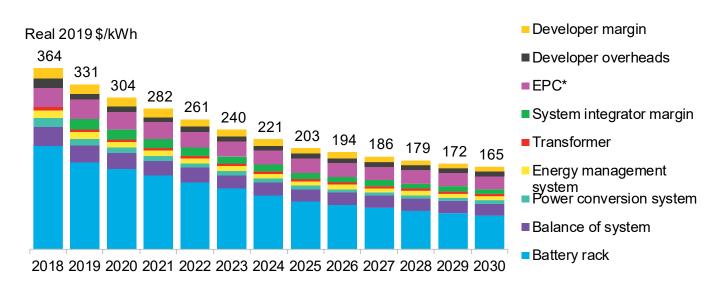




Sources: WoodMac, BNEF, BCSE

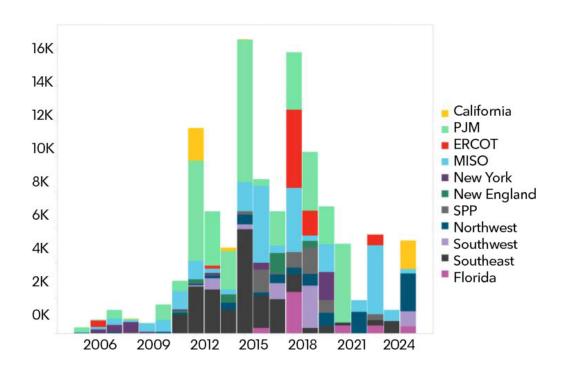
#### YoY energy storage system price decline, 2013 through 2024





Sources: WoodMac, BNEF, BCSE

### Historic and planned U.S. coal retirements (megawatts)



Moody's Investors Service projected coal could make up as little as 11% of U.S. power generation by 2030 based on scheduled and likely coal retirements alone.

Morgan Stanley projected (under a base-case scenario) that coal-fired electricity will decline from 27% of the total U.S. power mix in 2018 to just 8% by 2030.

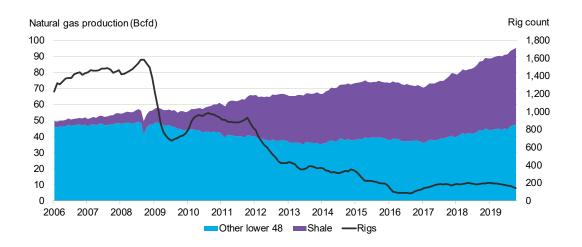
# **Key Observations**

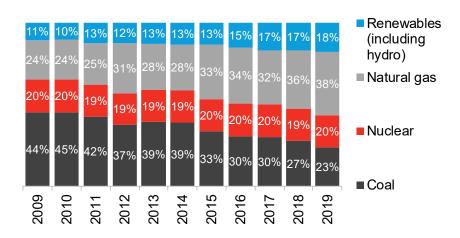
US coal fleet is now 20% smaller than it was a decade ago

An additional 26,947 MW to exit the market by 2025

2019 marks the highest level of annual coal capacity retirements in the US at 13,703MW

Sources: EIA Data, BNEF, S&P Global



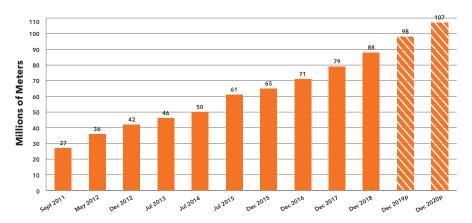


Rig count down, productivity and production up.

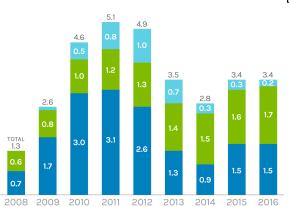
YoY, growth in electricity from natural gas and renewables has continued to increase

Sources: EIA Data, BNEF, BCES

#### US Smart Meter Deployments (2011—2019)



### EIA Data, BNEF, BCES



#### DISTRIBUTION-LEVEL INVESTMENTS INCLUDE:

#### \$MART METERING \$1.5 BILLION Smart meters and related communications and IT infrastructure

\$1.7 BILLION
Feeder and substation automation; distribution
management, volt/VAR optimization (VVO); conservation voltage reduction (CVR); fault detection, isolation,
and restoration; and outage management

#### **ADVANCED SMART GRID**

DISTRIBUTION AUTOMATION

#### \$0.3 BILLION

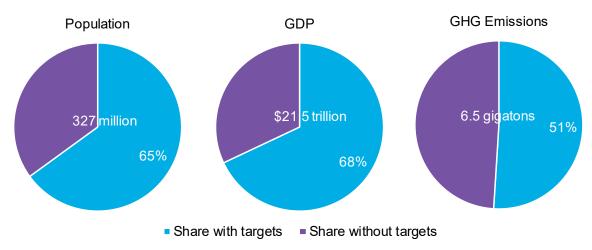
Grid applications that go beyond basic DA, including active network management, distributed generation integration, load control, home energy management, and EV charging.

# **Key Observations**

2010--2018 IOUs invested \$170 billion, or \$18.9 billion per year in transmission

Investment in the grid continue to move at pace

Transition in Thinking --- "Smart Grid" to "Smart Energy" Population, GDP and emissions of states and cities with greenhouse gas targets, compared to U.S. totals (2018)



### **Key Observation**

State and local jurisdictions, accounting for appx. 2/3 of the US population and GDP, and half of GHG emissions, have committed to CO2 reduction targets, with an eye toward meeting the Paris Accords

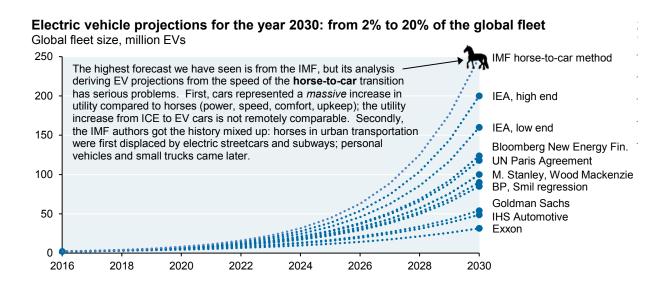
Sources: WoodMac

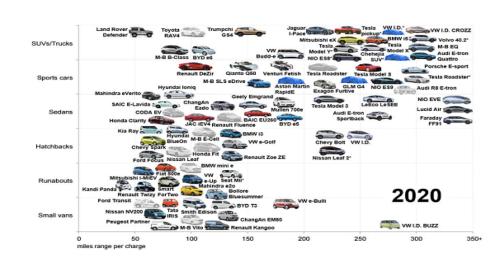
2010, U.S. consumers had virtually no choices when it came to EVs.

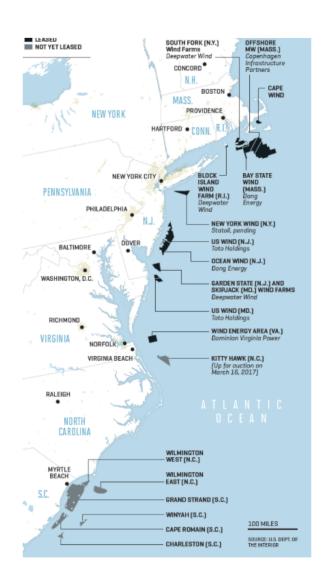
44 pure battery EV models are for sale in NA, along with 35 plug-in hybrids

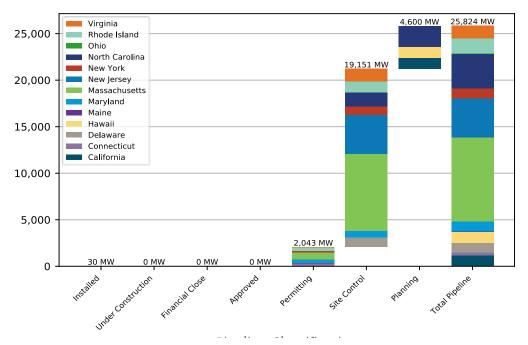
Manufacturers have promised another 40 BEV/PHEV choices by 2022

Appx. 71,000 charging points currently available





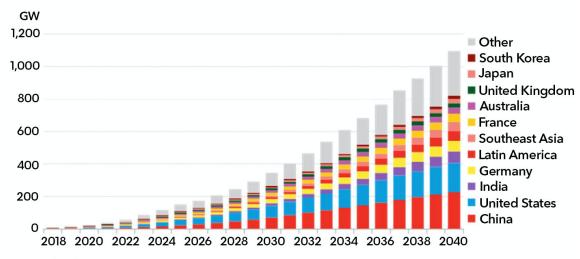




Offshore wind potential (total current pipeline is 25.8GW) while significant, remains nascent

Analyst projections of likely build range from 11.5 GW to 16.2 GW by 2030

### Global cumulative energy storage installations



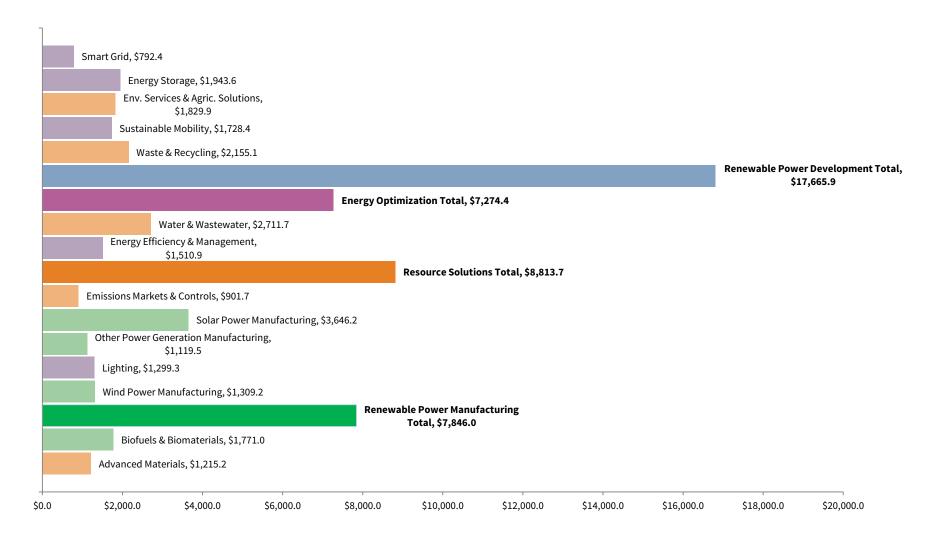
Source: BloombergNEF





Sources: BNEF, WoodMac

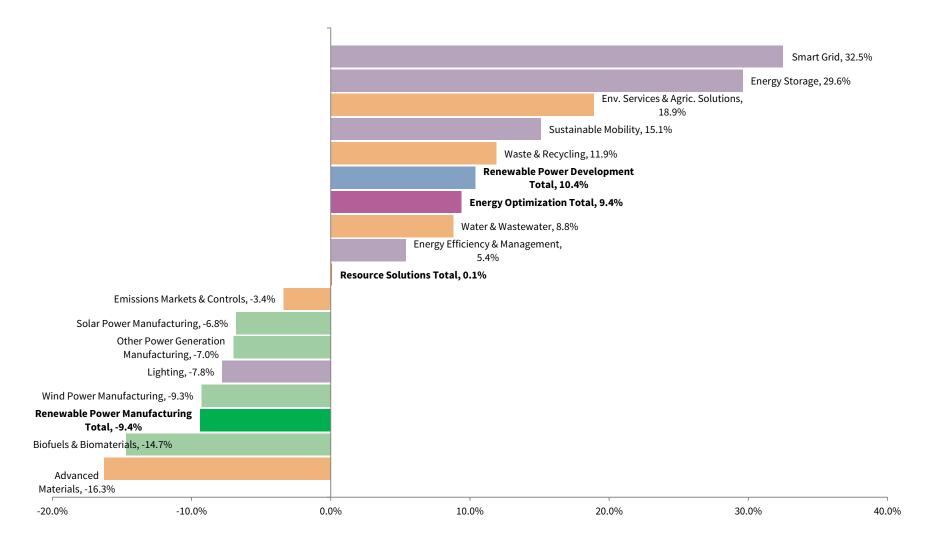
#### SINCE INCEPTION INVESTED CAPITAL BY CLEAN TECH SUBSECTOR (\$ MILLIONS)



Sources: Cambridge Associates

#### SINCE INCEPTION IRR BY CLEAN TECH SUBSECTOR

Pooled Gross IRR



Sources: Cambridge Associates