



# Addressing the Investment Challenge in a World of Climate Change

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*Lucas White*



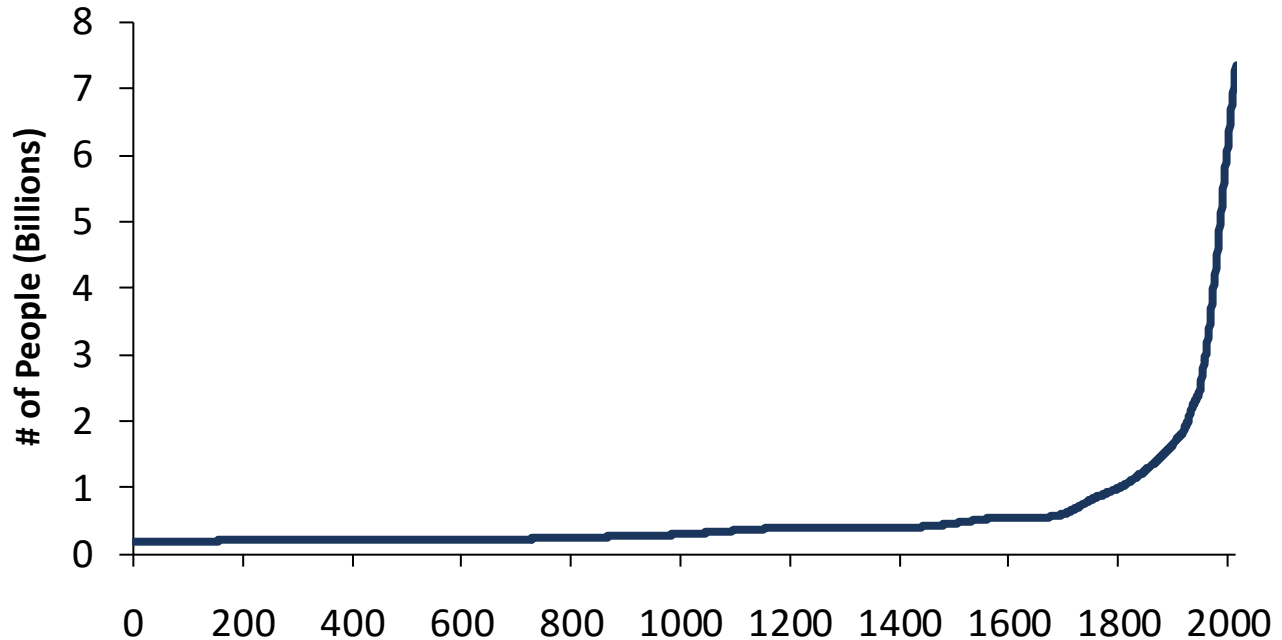
**Lucas White**

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Mr. White is a member of GMO's Focused Equity team. Previously at GMO, he served in other capacities, including portfolio management for the Global Equity team and leadership of strategic firm-wide initiatives. Prior to joining GMO in 2006, he worked as a programmer and analyst for Standish Mellon Asset Management. Mr. White earned his B.A. in Economics and Psychology from Duke University. He is a CFA charterholder.

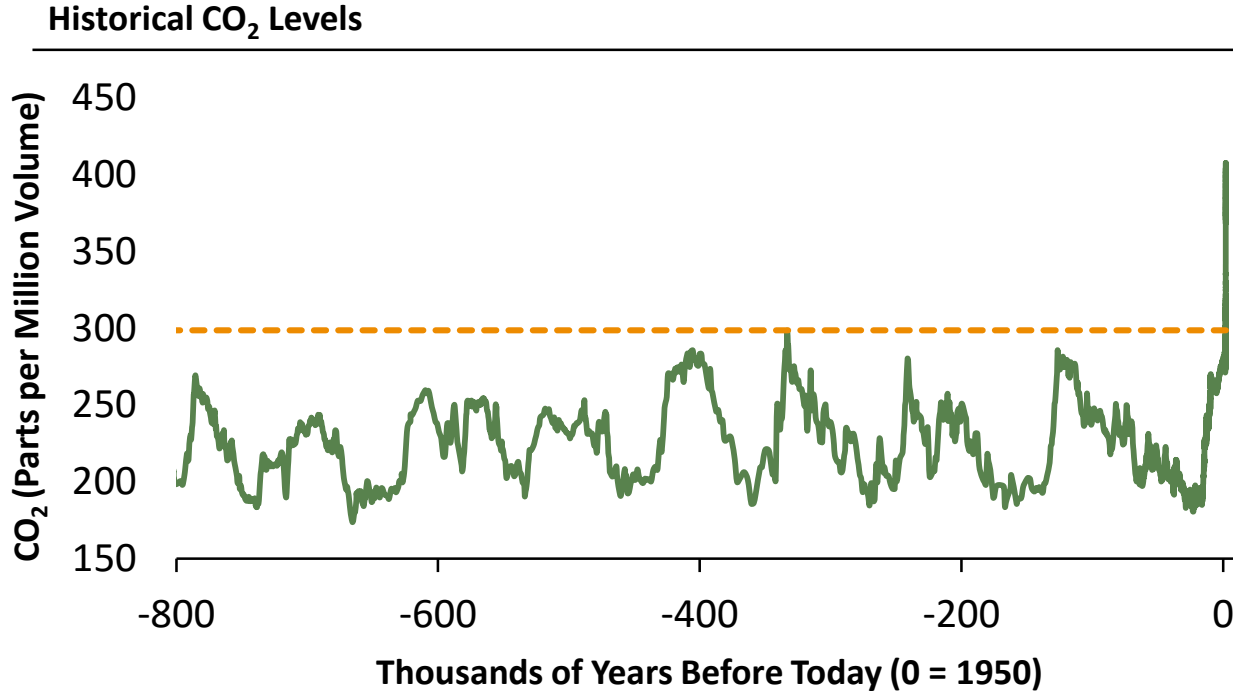
# It Would be More Surprising if Humans Were Not Dramatically Impacting the Environment

## Global Population



Source: NASA

# Greenhouse Gases Have Spiked to Record Levels

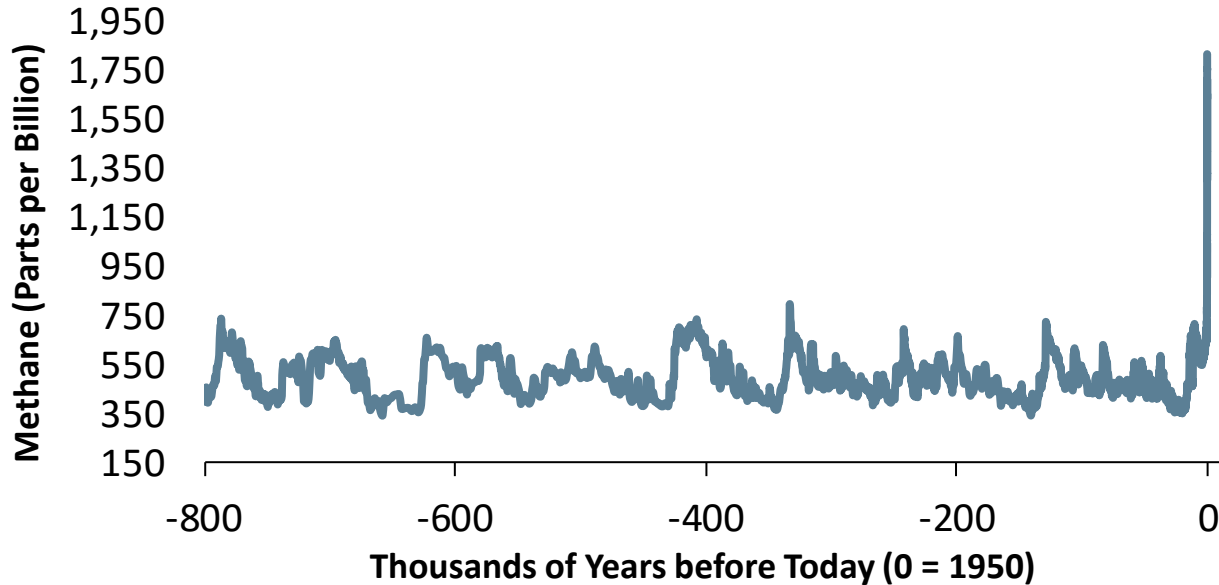


As of 12/2016  
Source: NOAA

# Methane Levels Are Often Overlooked...

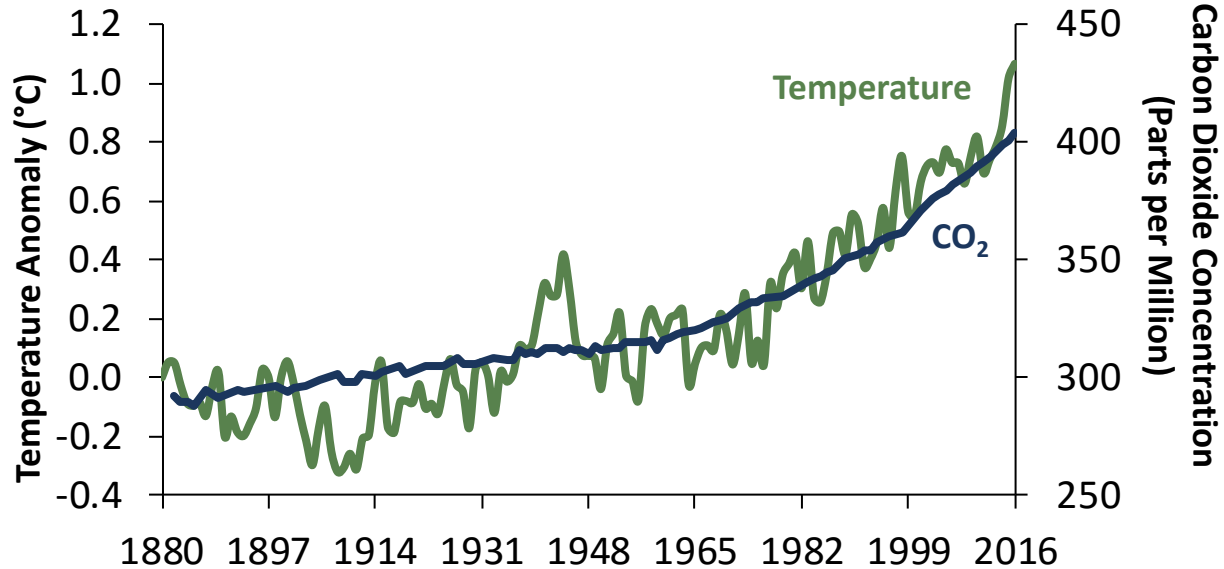
*...despite methane being more than 20 times more potent than carbon dioxide as a greenhouse gas*

## Historical Methane Levels



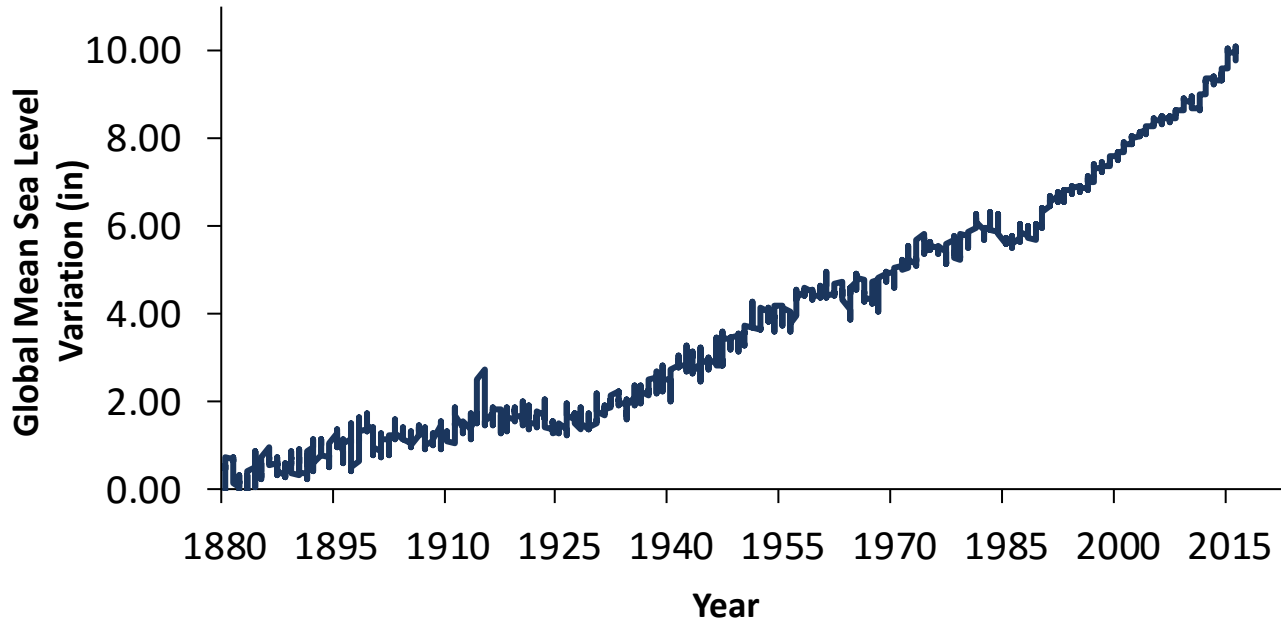
# Carbon Dioxide Concentrations and Temperatures Are Accelerating Upwards

## Carbon Dioxide Concentration and Temperature



# Sea Levels have Risen in Tandem with Temperatures

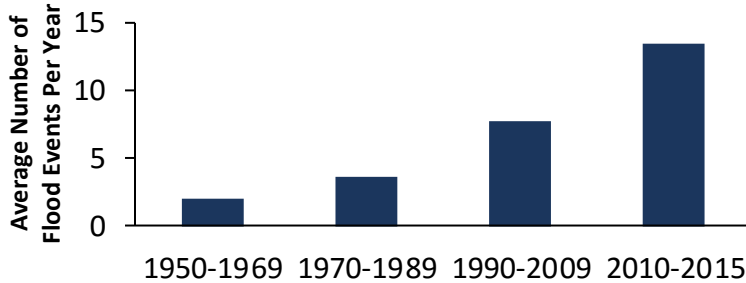
## Sea Levels (1880-2016)



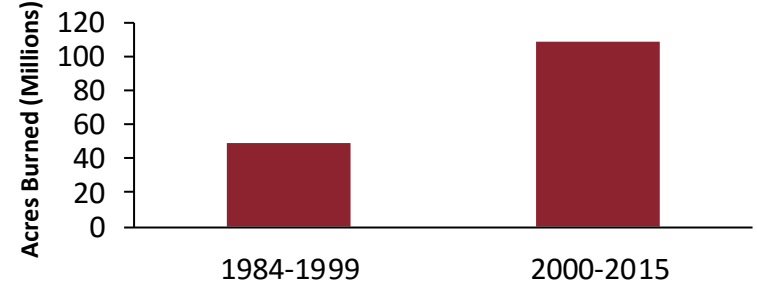
Source: NASA

# The Consequences of Climate Change Have been Widespread

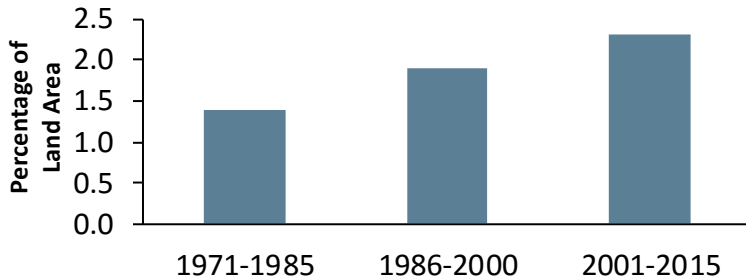
## Average Annual U.S. Coastal Flooding



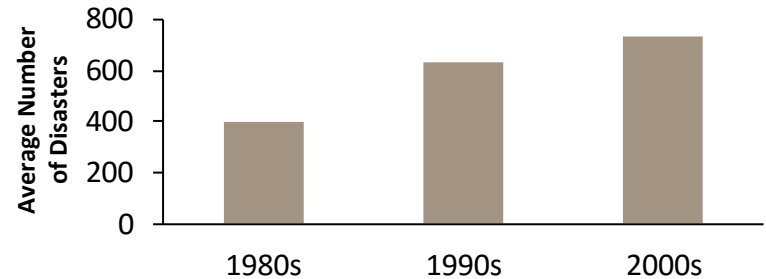
## Wildfire Impact in the U.S.



## Extreme Precipitation Events in the U.S.\*



## Global Natural Disasters



Source: EPA, NOAA, National Interagency Fire Center, The WorldWatch Institute

\* 48 continental states

# “When Global Warming Ends, About the Year 2060, the Ice Age Will Begin”

An alternate view from Samsung Chemical Coating Co. in a full page NY Times ad on March 7, 2017

EPOCH INFORMATION SYSTEMS (GMO) TIME

## When Global Warming Ends, about the year 2060, The Ice Age will Begin

**1. The Beginning of Global Warming**  
Global Warming is one of the natural phenomena that occurs at the end of interglacial period. At the end of the interglacial period, the equatorial sea level increases. The earth has two characteristics that the speed of its precession increases rapidly as the sea level increases, more and more in the equatorial region. About sea level, explain more about the title of our study on the 800 page of the Washington Post, Feb. 24, 2017. Also, as it progresses on the earth's shaking motion increases, the warm water in the equatorial region flows to the equator and the glacier in the polar region. As a result, the glacier melts several kilometers.

**2. There is No Relationship between Amount of Carbon Dioxide Emission and the Global Warming**  
Rapidly increased sea level makes the earth's precession increase. This increases the earth's sea level and causes the water level that flows in the equatorial region to rise more and more from there. **地球の海面上昇は、地球の自転速度を速くし、赤道地域に暖かい水が流れ込み、極地域の氷河を溶かす。**

First, as the earth's precession increases, the amount of sunlight entering the polar region rapidly increases, so the glaciers in the Polar Regions melt very rapidly.  
Second, the warm water of the equatorial region flows into the Polar region, so the glaciers melt very rapidly.  
In the future, due to above these causes, global warming, which the glaciers melt, is a rise of several dozen times faster, will occur even without carbon dioxide. In other words, the current global warming is caused by the synergy effect of increase of the earth's precession due to sea level rise. We can say that the cause of global warming is not from carbon dioxide emission.

**3. The End of Global Warming**  
The glaciers of the earth in present will be reduced to a minimum by about 2060 by the synergistic effect occur at the end of the interglacial.  
When the glacier is reduced to a minimum, the earth will again work to make glaciers. By about 2060, the Earth suddenly works in global warming and the ice age begins. When the ice age starts, the following environmental changes occur.  
(1) The N. pole and S. pole of the earth's magnetic field are located in the equatorial region, and about 90% of the force of the magnetic field disappears.  
(2) The warm sea water around the melted glaciers that flows into the Polar Region increases rapidly.  
(3) Axial precession is interrupted and the amount of sunshine in the polar region decreases rapidly.  
(4) Large tsunamis and earthquakes occur.  
(5) The reduction of the sea level causes the earth.  
(6) Heavy rains and heavy snow conditions.  
(7) Remove the range of temperature continues.  
(8) An ice age starts that lasts 200 years or so.

**4. Large extinction of living things**  
The ice age, which begins in about 2060, will end in about 2260. Glaciers will extend to near New York. During the ice age, which lasts for about 200 years, there will be a catastrophe similar to the movies 2012 and The Day After Tomorrow. The creatures living in the sky, the land, and the sea will become mass extinction. Large tsunamis and earthquakes will make dead creatures like coal and oil as in the past...At this time, the creatures that are exposed to solar radiation at the time of the ice age would become mutations and begin the birth of new species.

**5. To the US government and Scott Pruitt administrator of US Environmental Protection Agency**  
The global warming is caused by synergy effects between the sea level rise and the earth's precession. Even if the level of carbon dioxide is zero in the atmosphere, the global warming will proceed rapidly. There is no correlation between the cause of global warming and the increase of carbon dioxide emission. This is just a part of reason to be explained over several billions of years on the earth. The result of our study shows that global warming is over in about 2050, and then as the ice age suddenly begins, our humanity will become extinct. At present, there is no way to stop the ice age but to continue to reduce the amount of carbon dioxide emission. However, it is not possible to stop the ice age. The future of mankind depends on you and President Trump.

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“There is No Relationship between Amount of Carbon Dioxide Emission and the Global Warming.”

“...the current global warming is caused by the synergy effect of increase of the Earth’s precession due to sea level rise.”

“During the Ice Age, which lasts for about 200 years...the creatures living in the sky, the land, and the sea will become mass extinctions. Large tsunamis and earthquakes will make dead creatures like coal and oil as in the past...At this time, the creatures that are exposed to solar radiation at the time of the ice age would become mutations and begin the birth of new species.”

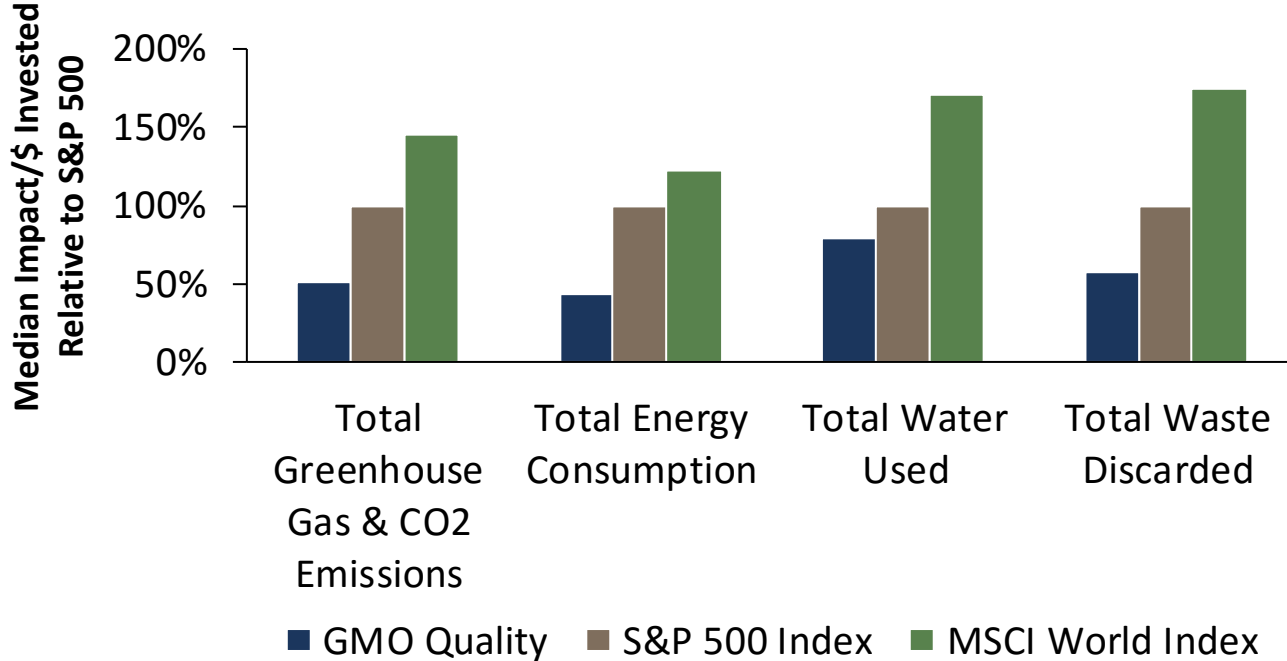
“The future of mankind depends on you and President Trump.”



## Quality Strategy

- Holistic integration of climate change and other ESG risks
- Exposure to Integrated Oil & Gas peaked at more than 13% in 2009
- By 2015, had sold all Integrated Oil & Gas companies due to stranded asset concerns (not divestment!)

# Quality Has Lower Risk From Environmental Impact



Source: Bloomberg, GMO

# Is “Green Resources Strategy” an Oxymoron?

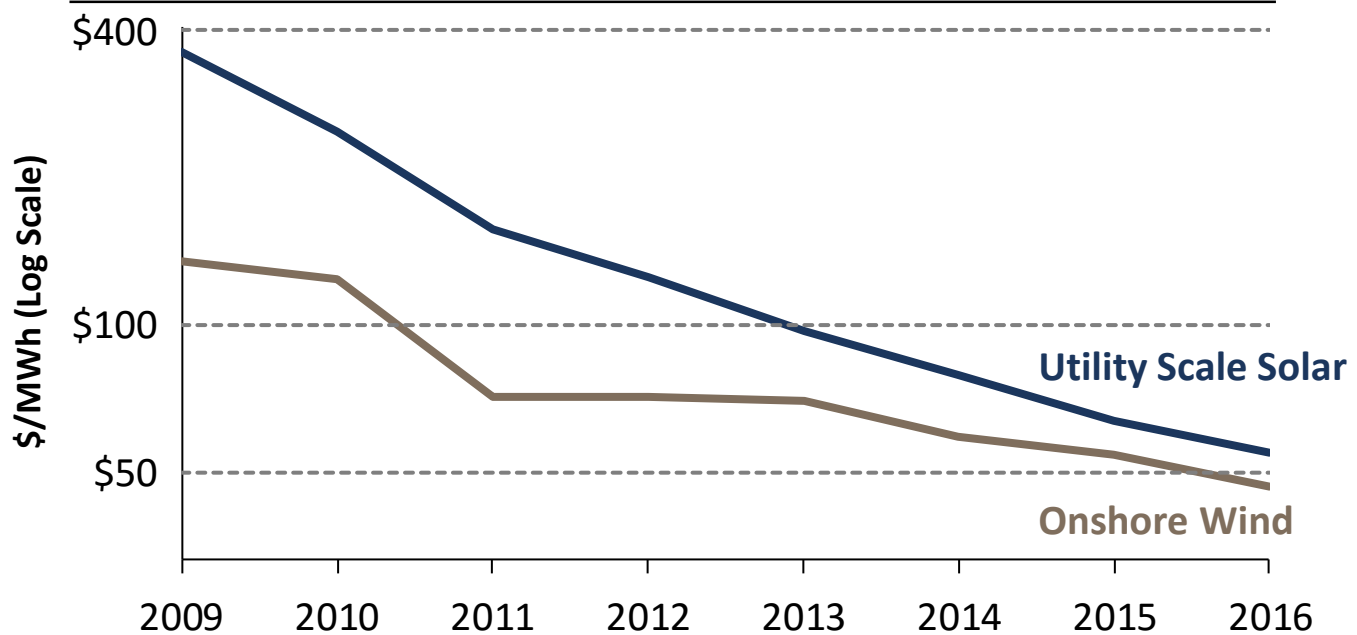
*Maybe, but...*

## Our Resources Strategy:

- Excludes coal and tar sands companies
- Excludes particularly poor ESG offenders
- Has a much lower energy exposure than the benchmark
- Part of energy exposure targeted to be Alternative Energy

# As Costs Continue to Drop for Wind and Solar, We Are Reaching an Inflection Point

Unsubsidized Levelized Cost of Energy over Time

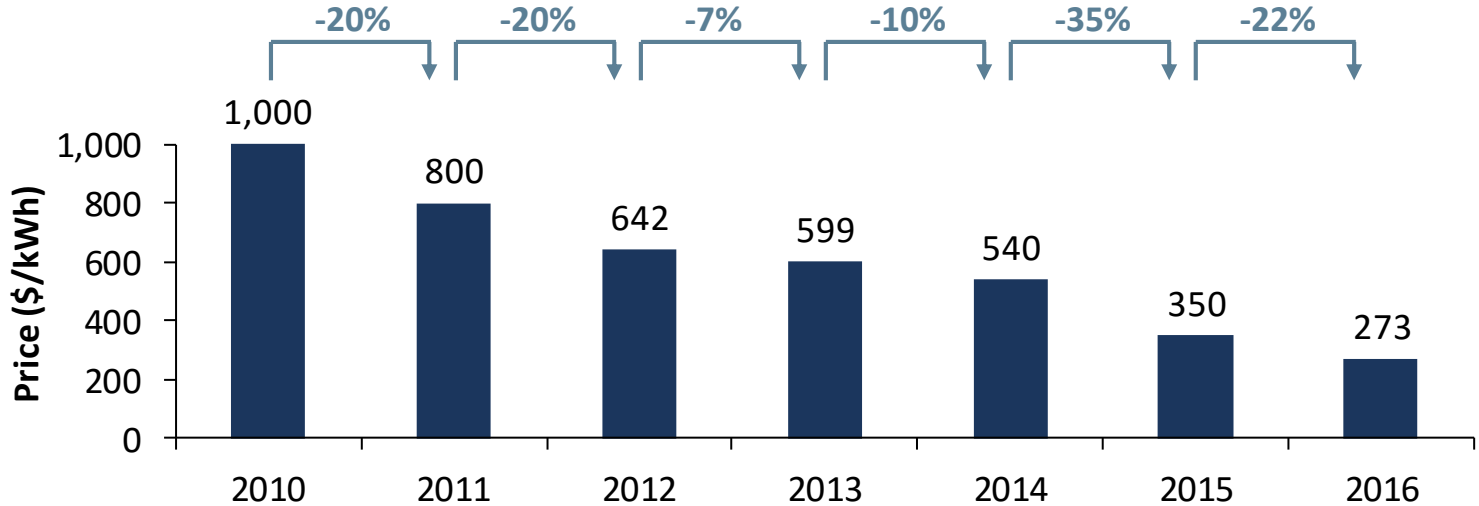


As of 12/31/16

Source: Lazard

# Battery Costs Continue to Drop as Well

Lithium-ion Battery Pack Prices

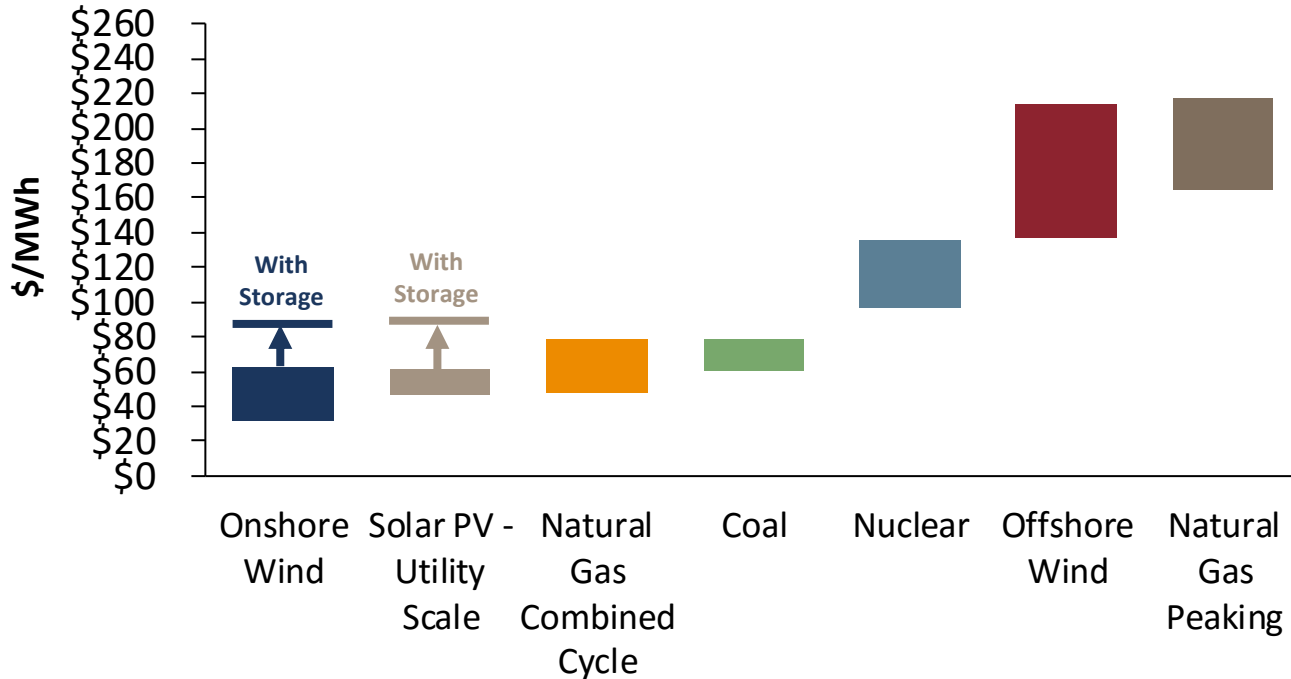


Source: Bloomberg New Energy Finance, 2017. Sustainable Energy In America Factbook

# Renewables Are Increasingly Competitive With Conventional Generation

*Solar bids have been as low as \$29.10/MWh in Chile and \$24.20/MWh in Abu Dhabi*

**Unsubsidized Levelized Cost of Energy in the U.S. by Source**



As of 12/31/16  
Source: Lazard, IJGGC, EIA

## The Climate Change Sector:

### 1. Companies involved in climate change mitigation

- Alternative Energy
- Batteries and Storage
- Energy/Buildings/Transportation Efficiency
- Pollution Control
- Technology and materials (copper, lithium) used in technology aimed at the mitigation of climate change

### 2. Companies involved in adaptation to climate change

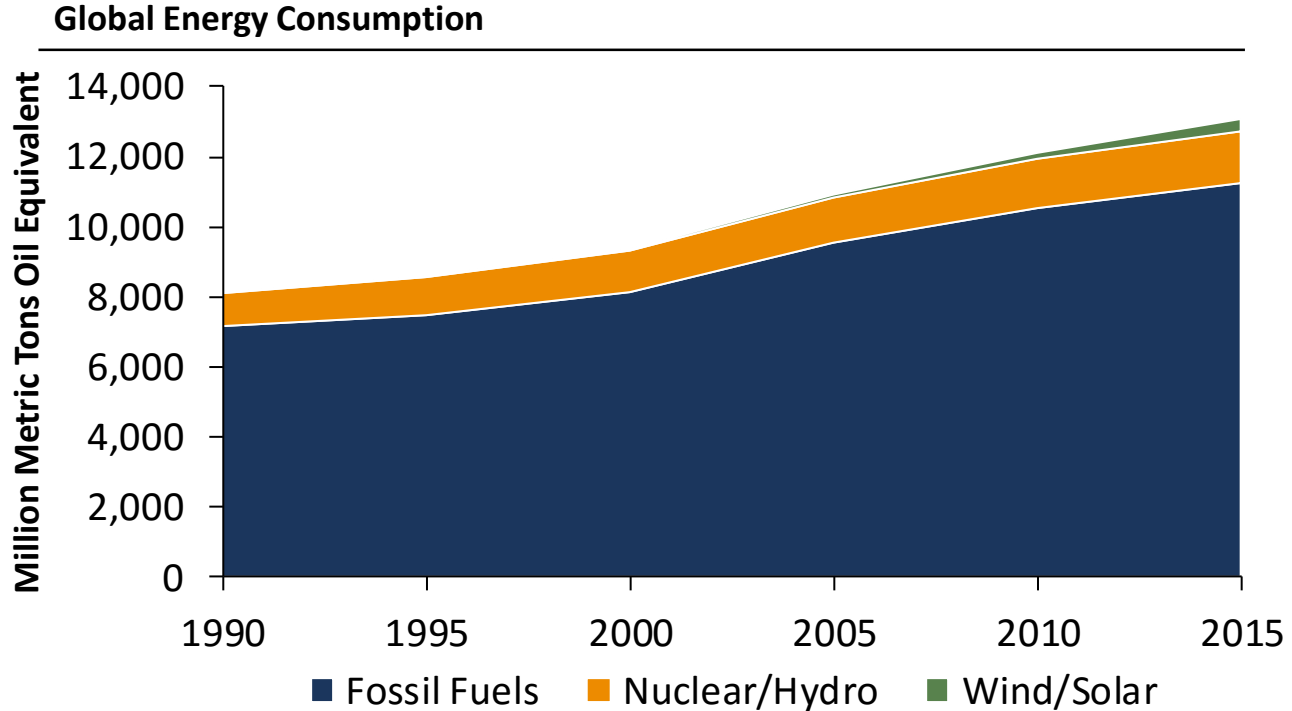
- Water treatment, processing, and recycling
- Agriculture
- Energy efficient air conditioning

## We Need a Massive Amount of Investment to Head Off Climate Change

- \$9 trillion to decarbonize electricity between 2016 and 2050
- \$6.4 trillion towards energy efficiency efforts in the building, industry, and transport sectors
- \$4-5 trillion to overhaul archaic electric grids



# Despite Tremendous Growth, Renewables Are Still a Small Piece of the Global Energy Puzzle

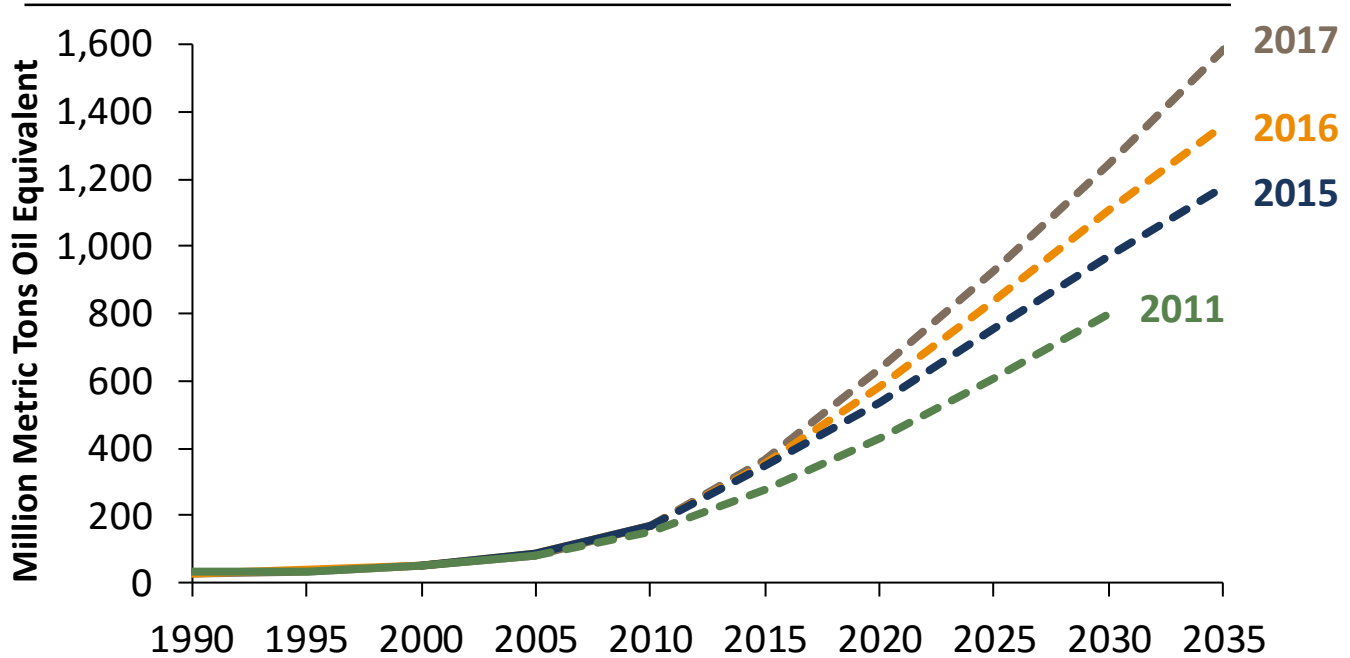


Source: BP

# The Climate Change Sector Will Experience Rapid Growth

*Al Gore: "...we must...ramp up our transition to a clean energy economy at a pace previously unimaginable."*

**Projections for Renewables Consumption**

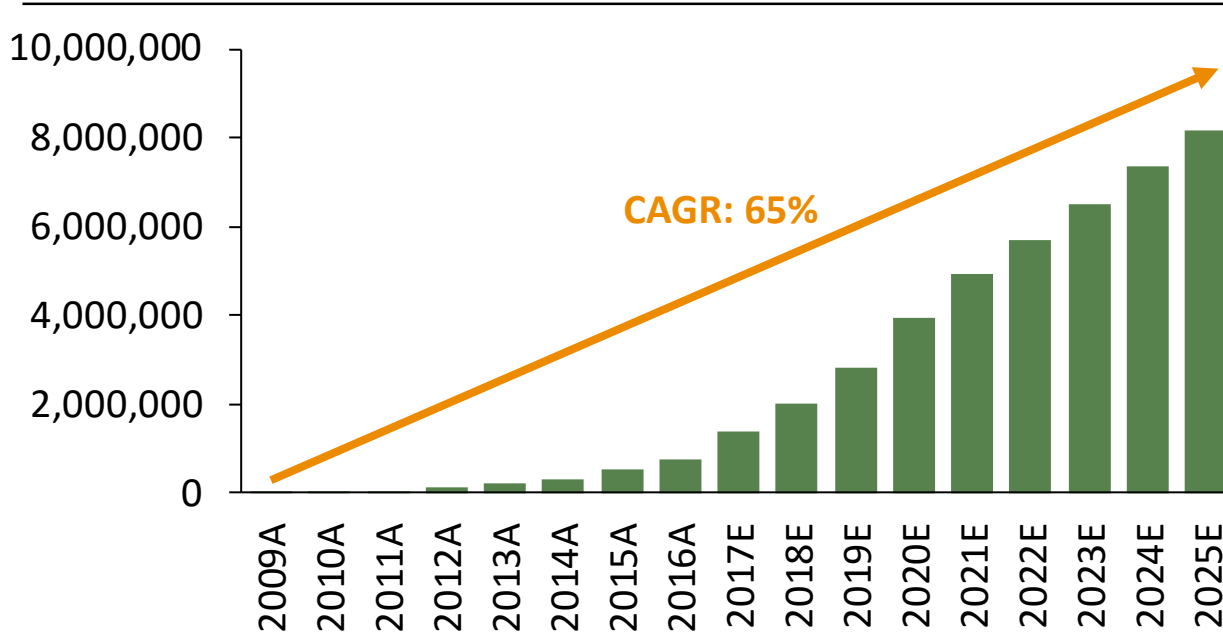


As of 2/2017  
Source: BP

# Electric Vehicle Sales Have Been Growing Dramatically

*...and are projected to grow rapidly over the next few decades*

**Global Electric Vehicle Sales**



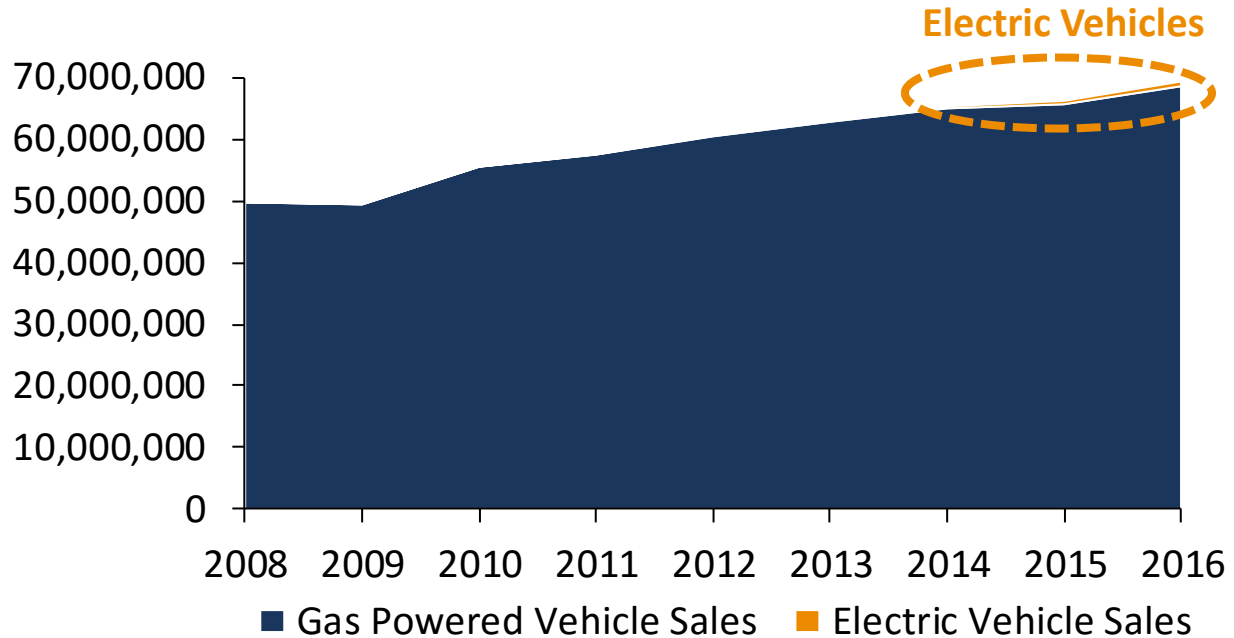
As of 2016

Source: International Energy Agency (IEA)

Electric vehicle sales include both battery electric cars and plug-in hybrid electric cars

# Electric Vehicles Represent a Tiny Fraction of Global Vehicle Sales

Global Passenger Vehicle Sales



Source: International Energy Agency (IEA), International Organization of Motor Vehicle Manufacturers (OICA)

Electric vehicle sales include both battery electric cars and plug-in hybrid electric cars

# Many Are Concerned About the Impacts of the Trump Administration on Climate Change Mitigation Efforts

*But will President Trump endanger an industry with job growth 8 times that of the broad U.S. job market?*

 **Donald J. Trump**   
@realDonaldTrump







The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.

RETWEETS 104,287 LIKES 66,472

11:15 AM - 6 Nov 2012

 12K  104K  66K 





 **Donald J. Trump**   
@realDonaldTrump

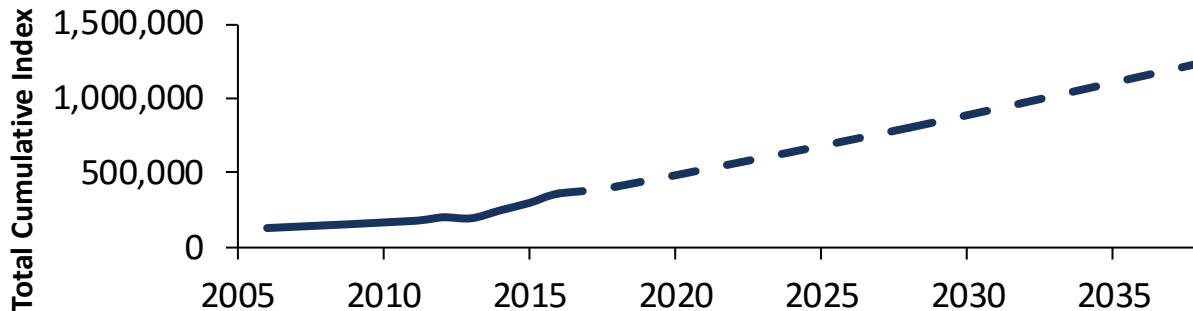
Big day on Thursday for Indiana and the great workers of that wonderful state. We will keep our companies and jobs in the U.S. Thanks Carrier

RETWEETS 17,259 LIKES 71,701

10:50 PM - 29 Nov 2016

 5.6K  17K  72K 

## U.S. Renewable Power Generation Job Growth Estimates

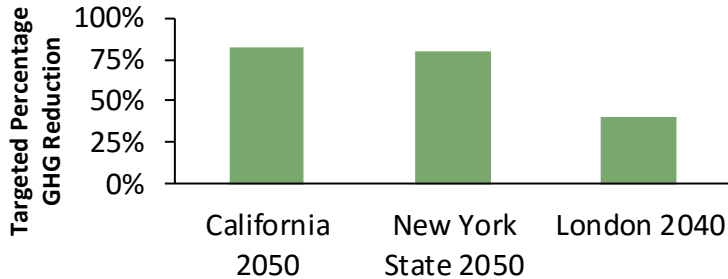


Source: USDA, Twitter

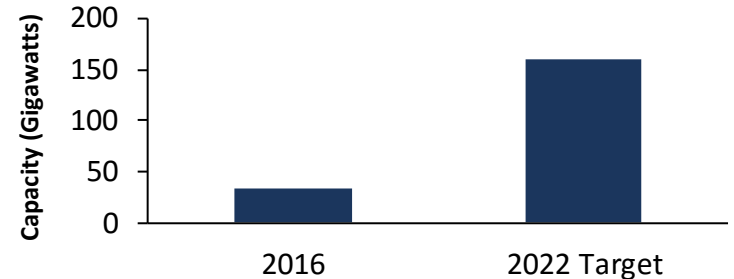
# Global Policies Will Support the Move to Sustainable Energy

*The Paris Accord, Global Covenant of Mayors, and other initiatives target greenhouse gas emission reductions*

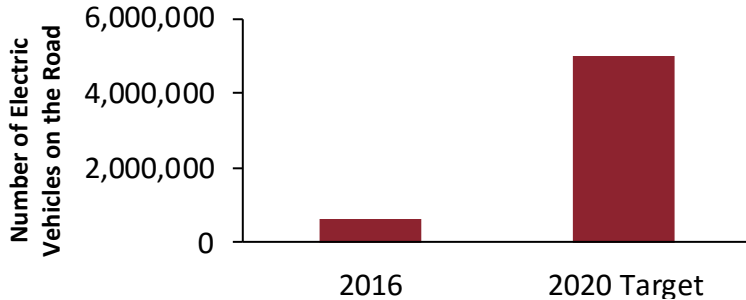
## Greenhouse Gas Emission Reduction Targets



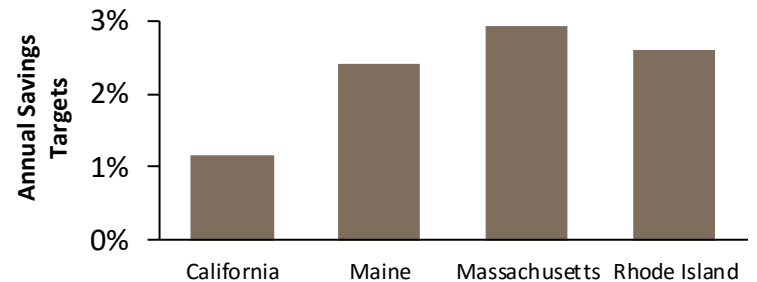
## India's Renewable Energy\* Capacity



## Chinese Electric Vehicle Fleet



## Incremental Energy Efficiency Standards

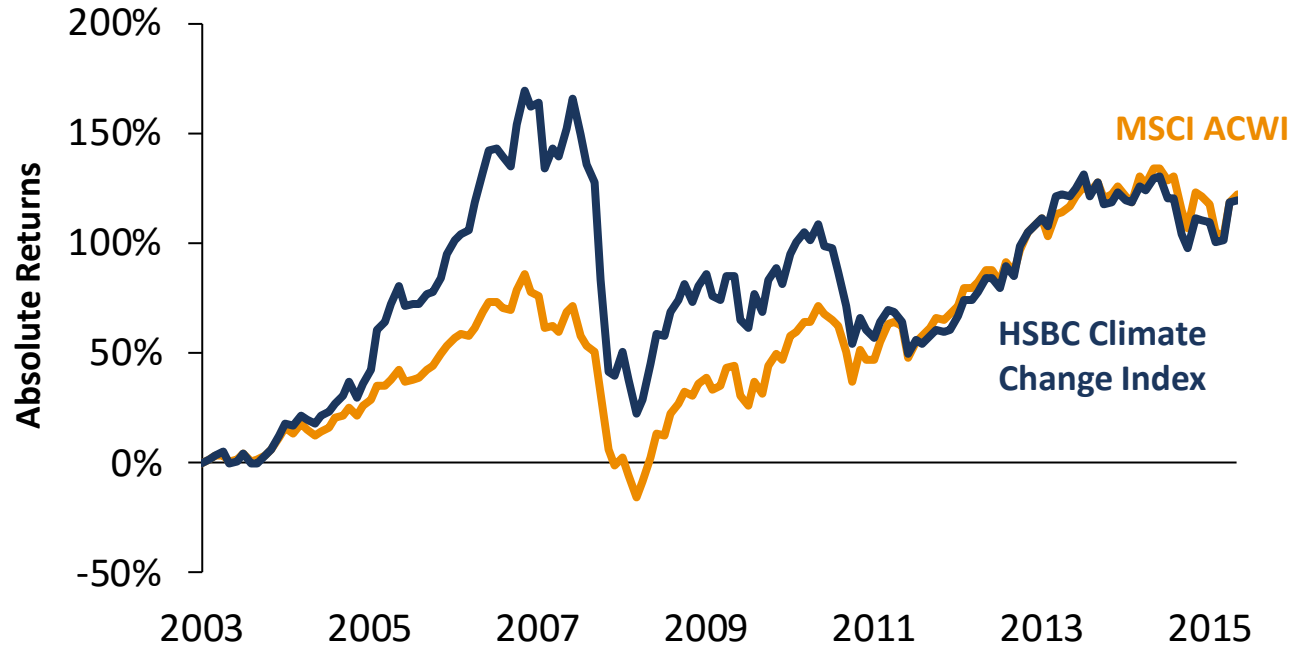


Source: Compact of Mayors, Global Covenant of Mayors, Government of India's Ministry of Power Central Electricity Authority, EVVolumes.com, ACEEE

\*Refers to wind and solar

# Have You Had to Sacrifice Returns to Invest in Companies That Do Good for the World?

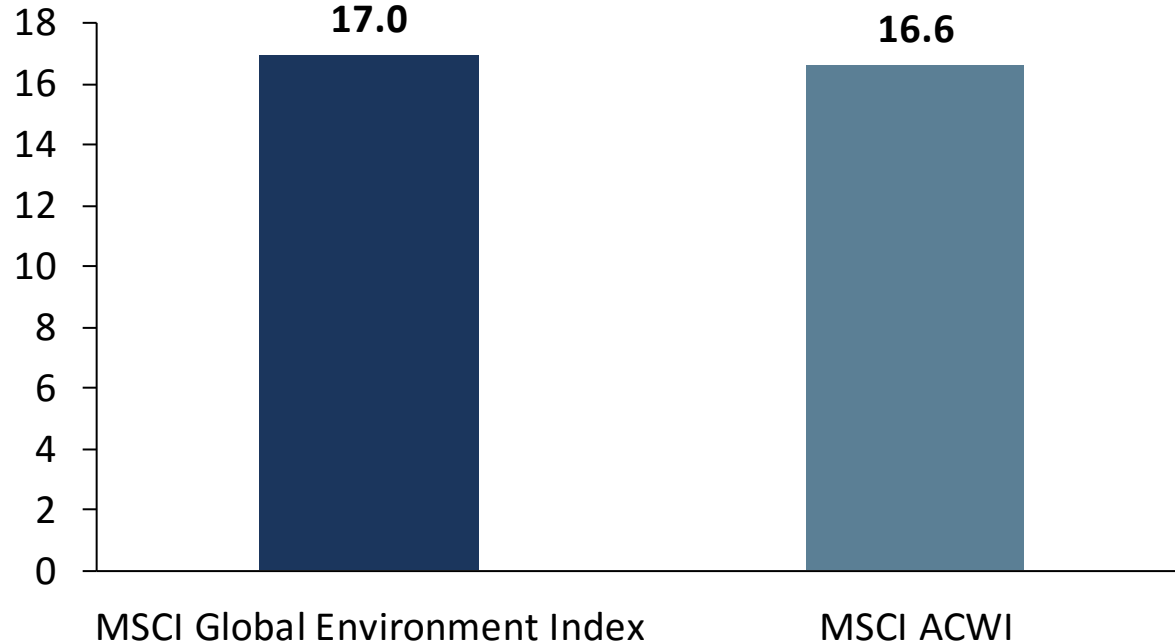
*No...after over a decade, the Climate Change sector kept up with the broad market*



As of 4/30/16  
Source: Bloomberg

# Companies Positioned for Dramatic Secular Growth Are Trading in Line With the Broad Market...

## Price/Forward Earnings



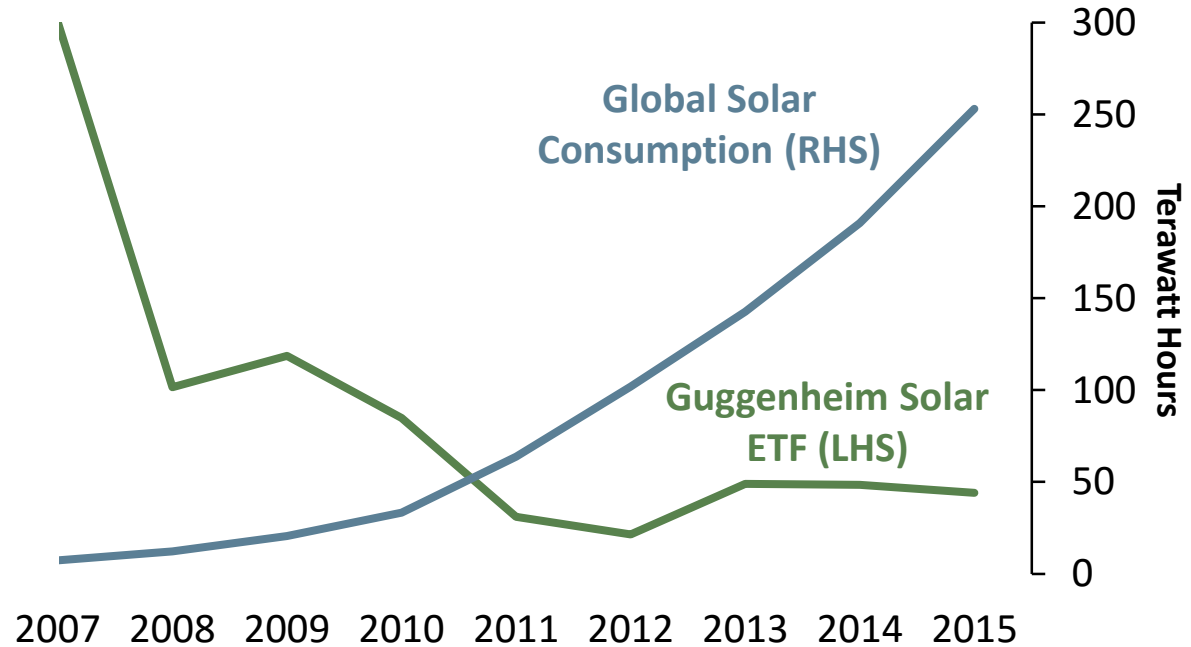
As of 12/31/16

Source: MSCI, IBES, GMO



# The Existence of Secular Growth Doesn't Mean Investing Is Easy...

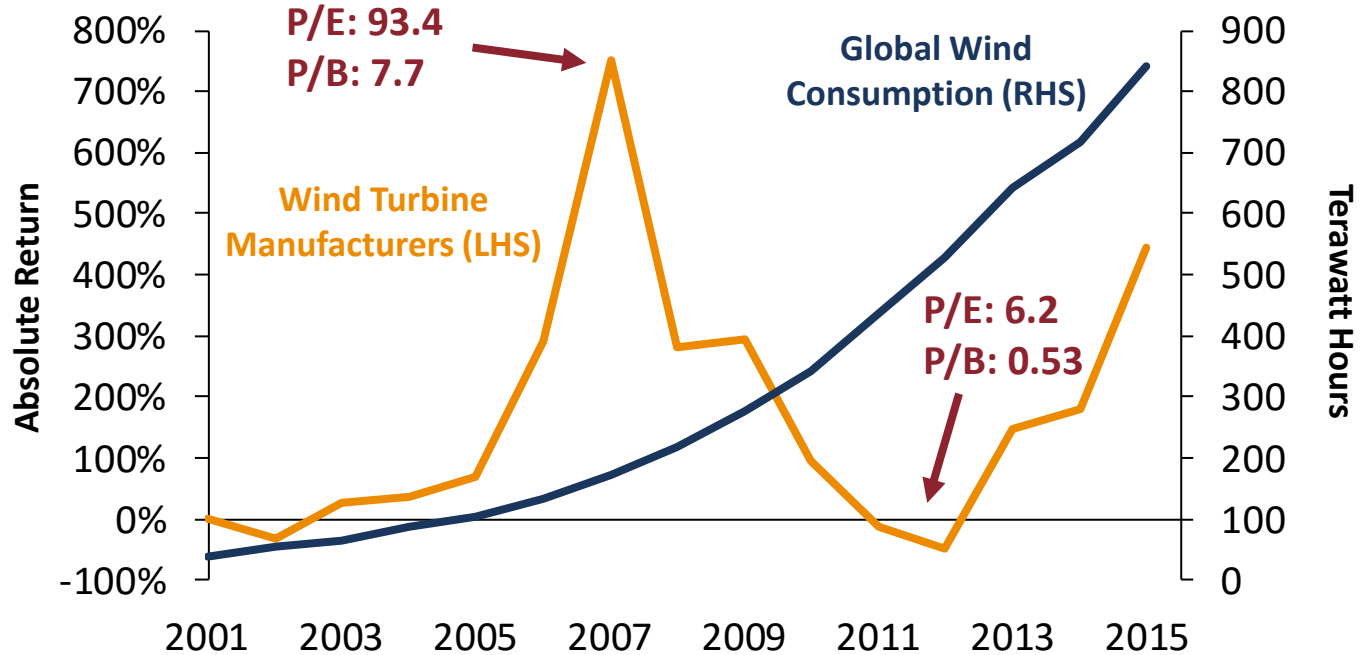
*Despite impressive growth in solar, solar companies have been terrible investments*



Source: BP, GMO

Vertically-Integrated Solar is comprised of First Solar, SunPower, Canadian Solar, and Jinkosolar

# However, a Value Orientation to a Secular Growth Sector Can Produce Outstanding Opportunities

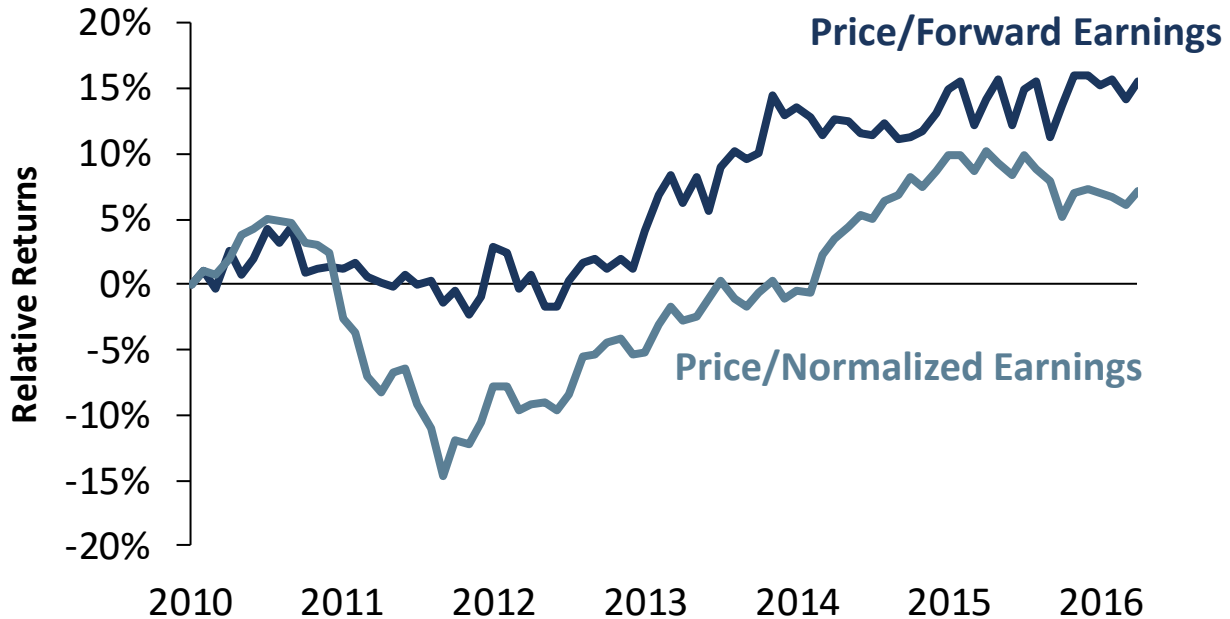


Source: BP, GMO

Footnote: Wind turbine manufacturers are Vestas, Gamesa, and Nordex. P/E ratios are based on normalized earnings.

# Value Has Worked Well in the Environmental Sector Recently...

**Performance of Cheapest Quartile P/E Stocks within the MSCI Global Environment Index Relative to the MSCI Global Environment Index**



As of 12/31/16  
Source: MSCI, GMO

# It's Reasonable To Think That This Could Be a Particularly Inefficient Sector

## Value has worked well

## Analyst coverage is low

- The average MSCI ACWI stock had 50%+ more coverage than the average HSBC Climate Change Index stock as of March 2016

## The companies are relatively small

- The largest solar company is around \$3b in investable market cap
- The largest wind company is around \$15b in investable market cap

## This is a relatively new, poorly understood sector

- Requires a combination of being able to see the big picture and analyze companies

## This sector is unlikely to be picked over by value managers

- This is a volatile, high growth sector

- Climate change is a critically important investment issue that poses risks...and presents opportunities
- Economics will drive the transition to a clean energy world
- There will be tremendous investment opportunities in the climate change sector...but we believe a disciplined, value-oriented approach will be critical in navigating this high growth sector