Climate Change Risks and Opportunities: What the Paris Agreement Means for Business

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Global Temperature and Carbon Dioxide

Global temperature data averaged and adjusted to early industrial baseline (1881-1910).
Source: NASA GISS, NOAA NCEI, ESRL
Global temperature and the Holocene safe-climate zone

The temperature reconstruction of Shakun et al. (green – shifted manually by 0.25°C); Marcott et al. (blue); combined with the instrumental period data from HadCRUT4 (red) and model average of IPCC projections for the A1B scenario up to 2100 (orange).

With warming of 0.8°, current temperature is ~0.1°C above the Holocene maximum.

The Holocene(maximum)

The Holocene temp. range of human civilisation

The Holocene

The safe climate zone

Pre-industrial

BAU warming by 2100

2° of warming
Record-Low Arctic Sea Ice Max
Area of Arctic Sea Ice Extent

(Million Square Miles)

Average

2016-17

Previous Record (2015-16)

December January February March April

Area of Ocean with at Least 15% Ice
Source: National Snow and Ice Data Center
# Climate change impacts

**Stern Commission**

<table>
<thead>
<tr>
<th>Global temperature change (relative to pre-industrial)</th>
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<tbody>
<tr>
<td>0°C</td>
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<tr>
<td><strong>Food</strong></td>
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<td>Falling crop yields in many areas, particularly developing regions</td>
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<td>Possible rising yields in some high latitude regions</td>
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<tr>
<td>Falling yields in many developed regions</td>
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<td><strong>Water</strong></td>
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<td>Small mountain glaciers disappear – water availability in many areas, including Mediterranean and Southern Africa</td>
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<td>Sea level rise threatens major cities</td>
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<td><strong>Ecosystems</strong></td>
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<tr>
<td>Extensive Damage to Coral Reefs</td>
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<td>Rising number of species face extinction</td>
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<td><strong>Extreme Weather Events</strong></td>
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<td>Rising intensity of storms, forest fires, droughts, flooding and heat waves</td>
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<td><strong>Risk of Abrupt and Major Irreversible Changes</strong></td>
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<td>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</td>
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*From UK Stern Commission Economics of climate change 2006*
Climate Risks to Sustainable Development

- Existential Risks
- Slow Onset Risks
- Disaster Risks
- Cross-cutting Risks
  - Food security
  - Poverty eradication
Existential Risks
Slow Onset Risks: Gradual Degradation of Land and Habitats
Slow Onset Risks: Drought and Desertification
Disaster Risks

Climate change and the wildfires in Chile
Cross-Cutting Risks: Food Security and Poverty Eradication
2100 WARMING PROJECTIONS
Emissions and expected warming based on pledges and current policies

- Warming projected by 2100
  - Baseline: 4.1 – 4.8°C
  - Current policies: 3.1 – 3.7°C
  - Pledges: 2.6 – 3.2°C
  - 2°C consistent: 1.5 – 1.7°C
  - 1.5°C consistent: 1.3 – 1.5°C

Historical emissions

Global greenhouse gas emissions (GtCO₂e/year)

Sources: Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report scenario database, 1.5 °C scenarios from scientific literature (see footnote 19), IPCC historical emission database and intended nationally determined contribution quantification.
Individual country assessments

Select a country from the map below to view their individual assessment.

- CRITICALLY INSUFFICIENT
  Commitments with this rating fall well outside the fair share range and are not at all consistent with holding warming to below 2°C, let alone with the Paris Agreement’s stronger 1.5°C limit. If all government targets were in this range, warming would exceed 4°C.

- HIGHLY INSUFFICIENT
  Commitments with this rating fall outside the fair share range and are not at all consistent with holding warming to below 2°C, let alone with the Paris Agreement’s stronger 1.5°C limit. If all government targets were in this range, warming would reach between 3°C and 4°C.

- INSUFFICIENT
  Commitments with this rating are in the least stringent part of their fair share range and not consistent with holding warming below 2°C, let alone with the Paris Agreement’s stronger 1.5°C limit. If all government targets were in this range, warming would reach over 2°C and up to 3°C.

- 2°C COMPATIBLE
  Commitments with this rating are consistent with the 2009 Copenhagen 2°C goal and therefore fall within the country’s fair share range, but are not fully consistent with the Paris Agreement. If all government targets were in this range, warming could be held below, but not well below, 2°C and still be too high to be consistent with the Paris Agreement’s 1.5°C limit.

- 1.5°C PARIS AGREEMENT COMPATIBLE
  This rating indicates that a government’s efforts are in the most stringent part of its fair share range. It is consistent with the Paris Agreement’s 1.5°C limit.

- ROLE MODEL
  This rating indicates that a government’s efforts are more ambitious than what is considered a fair contribution. It is more than consistent with the Paris Agreement’s 1.5°C limit.
As nationally determined contributions to the global response to climate change, all Parties are to undertake and communicate ambitious ... with the view to achieving the purpose of this Agreement as set out in Article 2. The efforts of all Parties will represent a progression over time, while recognizing the need to support developing country Parties for the effective implementation of this Agreement.
Timeline: How countries plan to raise the ambition of their climate pledges

The Paris “ratchet mechanism” is designed to steadily increase ambition over time, ensuring that the world reaches net zero emissions in the second half of the century and keeps temperature rise “well below 2°C”.

1. Climate plans submitted
   Countries submit their first round of climate pledges (NDCs). Some cover the period up to 2025, some up to 2030.

2. Facilitative dialogue
   To take stock of collective efforts of countries in relation to the long-term goal of the agreement and to inform the preparation of the next round of pledges.

3. By 2020
   Countries with 2025 targets communicate their second round of climate pledges, while countries with 2050 targets communicate or update their pledge.
   New climate pledges will then be submitted every 5 years.

4. Global stocktake
   On mitigation, adaptation and finance.

5. By 2025
   Countries submit their third round of climate pledges.

6. Second stocktake
   On mitigation, adaptation and finance.
Three Pillars of Deep Decarbonization

Energy Efficiency

Decarbonization of Electricity

End Use Fuel Switching to Electric Sources

Key Metric of Transformation

Energy Intensity of GDP (MJ/$2005)

Electricity Emissions Intensity (gCO2/kWh)

Share of Electricity and Electric Fuels in Total Final Energy (%)

Pathways to Deep Decarbonization in the United States, Mixed case results
How each technology area contributes to CO2 emissions reductions

ETP 2DS Scenario. Click a technology in the legend to show/hide.

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In the Reference case, Asia accounts for most of the increase in energy use in non-OECD regions—

Non-OECD energy consumption by region
quadrillion Btu

[Bar chart showing energy consumption by region from 1990 to 2040, with a significant increase in Asia by 2015.]
Energy consumption increases over the projection for all fuels other than coal in the Reference case—

World energy consumption by energy source
quadrillion Btu

- Petroleum and other liquids
- Coal
- Natural gas
- Renewables
- Nuclear
Wind and solar dominate growth in renewables—

World net electricity generation from renewable power
trillion kilowatthours

percent share of renewable energy

Falling Costs for Clean Energy Technologies

Indexed Cost Reductions Since 2008

- Land-Based Wind
- Distributed PV
- Utility-Scale PV
- Modeled Battery Costs
- LEDs
Figure ES.2 The levelised cost of electricity for projects and global weighted average values for CSP, solar PV, onshore and offshore wind, 2010-2022

Source: IRENA Renewable Cost Database and Auctions Database.
Note: Each circle represents an individual project or an auction result where there was a single clearing price at auction. The centre of the circle is the value for the cost of each project on the Y axis. The thick lines are the global weighted average LCOE, or auction values, by year. For the LCOE data, the real WACC is 7.5% for OECD countries and China, and 10% for the rest of the world. The band represents the fossil fuel-fired power generation cost range.
Lazard’s latest annual Levelized Cost of Energy Analysis (LCOE 11.0) shows a continued decline in the cost of generating electricity from alternative energy technologies, especially utility-scale solar and wind.

[Diagram: Unsubsidized Levelized Cost of Energy Comparison]

- Solar PV—Rooftop Residential: $187
- Solar PV—Rooftop C&I: $194
- Solar PV—Community: $150
- Solar PV—Crystalline Utility Scale: $85
- Solar PV—Thin Film Utility Scale: $43
- Solar Thermal Tower with Storage: $98
- Fuel Cell: $106
- Microturbine: $59
- Geothermal: $77
- Biomass Direct: $55
- Wind: $30
- Diesel Reciprocating Engine: $197
- Natural Gas Reciprocating Engine: $69
- Gas Peaking: $156
- IGCC: $99
- Nuclear: $112
- Coal: $60
- Gas Combined Cycle: $42

Denotes distributed generation technology.
Developed country Parties shall continue taking the lead by undertaking economy-wide absolute emission reduction targets. Developing country Parties should continue enhancing their mitigation efforts, and are encouraged to move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances.
In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.
Figure 1. Emissions trajectories for energy CO₂, 2010-2050, showing most ambitious reduction scenarios for all DDPP countries. 2050 aggregate emissions are 57% below 2010 levels.
Development Opportunities in Climate Action

• Renewable energy
  – Industrial scale
  – Distributed generation

• Energy efficiency
  – Buildings/Materials
  – Cookstoves

• Carbon Markets
  – REDD+ , Article 6
  – ICAO

• Climate-related finance
  – Private sector
  – Green bonds
  – International financial institutions
  – International development assistance
**Into the Trillions**

Investment in power generation technologies, 2017 to 2040

- Wind
- Solar
- Nuclear
- Hydro
- Gas
- Coal
- Everything else

Source: Bloomberg New Energy Finance New Energy Outlook 2017

Note: "Everything else" includes geothermal, biomass and oil-fired power.
FIGURE 4. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED V DEVELOPING COUNTRIES, 2004-2016, $BN

New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals. Developed country volumes are based on OECD countries excluding Mexico, Chile, and Turkey.

Source: UN Environment, Bloomberg New Energy Finance
FIGURE 1. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY BY ASSET CLASS, 2004-2016, $BN

Growth:
55% 55% 41% 14% -2% 37% 15% -9% -8% 19% 12% -23%

*Asset finance volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.
Source: UN Environment, Bloomberg New Energy Finance
To date, the vast majority of clean energy power generation debt has been financed through direct loans from project finance institutions, such as major banks.

However, other industries raise similar or much larger volumes of capital in a wider diversity of ways. As perceptions of risk mature, similar results can be expected for new renewables.

As clean energy continues to scale, the industry will expand the variety of sources of capital it taps to grow, with expanding investment opportunities in virtually every new renewable asset class.
The Problem for Investors

“Climate change is occurring. It has important implications for economic activity and therefore corporate performance. The effects of climate change are beginning to play out within and among industries and regions. They are likely to grow in significance in the years to come, becoming an increasingly important factor in the relative performance of firms, industries and investment portfolios.”

CDSB Statement on Fiduciary Duty and Climate Change Disclosure
The Problem for Investors (cont.)

“... financial markets do not yet take sufficient account of climate-related corporate performance, risks and opportunities relevant to future shareholder value because of a lack of comprehensive and comparable information in ‘mainstream’ corporate reports for the investment community. This information gap undermines the efficiency by which markets are able to allocate capital to its most productive uses over the medium to long term....”

CDSB Statement on Fiduciary Duty and Climate Change Disclosure
Climate Risk for Companies

- Regulatory Risk
- Litigation Risk
- Reputation Risk
- Transition Risk (and Opportunity)
- Climate Impacts Risk (and Opportunity)
Regulatory Risk

Current Laws and Regulations

- GHG emissions
- Natural resources management
  - Fossil fuel extraction
- Energy efficiency standards
- Securities and/or Blue Sky Laws
Regulatory Risk

Future Law and Regulation

- Carbon tax
- GHG emissions limits
- Cap-and-trade programs
- Fossil fuel bans
- Energy efficiency standards
- Process or product standards
Litigation Risk

Failure to disclose

• “Corporations and their management and directors are facing more risks in connection with climate change-related financial disclosures and the potential for shareholder and derivative suits based on alleged climate change-related financial nondisclosures.” (Anderson, Kill & Olick, 2011)
Litigation Risk

Third Party Actions

- Failure to mitigate
  - Injunctions against business activities
  - Compensation for damages
- Failure to adapt
  - Injunctions to undertake adaptation
  - Compensation for damages
Transition Risk and Opportunity

• Impact on Business Prospects

• New Business Opportunities

• Stranded Assets
  • 2 degree stress test
    • Article 173 of French law on Energy Transition for Green Growth
    • Recent shareholder proposals in the US
Climate Impacts: Risk and Opportunity

- Climate Impacts
  - Changing weather patterns
  - Sea level rise
  - Shifts in species distribution
  - Changes in water availability
  - Changes in temperature
  - Variation in agricultural yield and growing seasons
- Impacts on Infrastructure and Real Property
- Impacts on Supply Chains
- Impacts on Operations
- Impacts on demands for services and products
Investor Strategies

Philanthropy: Fully oriented to positive impact
Thematic Investing: Investments in thematic sectors
Sustainable Investing (ESG): Positive screen
Socially Responsible Investing (SRI): Negative screen
Mainstream Investing: No consideration of impact
Gracias!

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