GLOBAL SECURITY INITIATIVE

Decision Making and Climate Security for Business

January 27th, 2016

Clark Miller
Senior Sustainability Scientist and Professor,
School for the Future of Innovation in Society

Edward Saltzberg
Managing Director
Security and Sustainability Forum
Upcoming Webinars

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SSF /ASU Webinars Coming Up:

• Global Governance in the Face of Non-Traditional Risk – February 18th, 2016

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Agenda

• A. Introduction: Moderator Clark Miller
• B. Panel PowerPoint Briefings:
  - Kate Gordon, Vice Chair of Climate and Sustainable Urbanization at the Paulson Institute
  - David Livingston, Associate in Carnegie’s Energy and Climate Program
  - Lindene Patton, Independent Consultant – Risk and Financial Services
  - Nancy Colleton, President of the Institute for Global Environmental Strategies (IGES)
• C. Discussion Questions
• D. Audience Questions – type in the Go to Webinar window
• E. Panel Summary and Closing
  Please remember to take the exit survey
Supporting Partners
**Clark Miller** is a Senior Sustainability Scientist with the Julie Ann Wrigley Global Institute of Sustainability Associate and Professor, School for the Future of Innovation in Society. His research focuses on science, technology & globalization, with a particular emphasis on the design and critical analysis of knowledge systems in support of international and global policy making. He is the co-editor of Changing the Atmosphere: Expert Knowledge and Environmental Governance (with Paul Edwards); Arizona’s Energy Future; and Nanotechnology, the Brain, and the Future.
A university-wide interdisciplinary hub for global security research

VISION: A security and intelligence landscape transformed through interdisciplinary research and discovery, in which defense, development and diplomacy operate collaboratively to drive positive outcomes for complex global challenges.
Decision Making and Climate Security for Business

Nancy Colleton
President of the Institute for Global Environmental Strategies (IGES)

Kate Gordon
Vice Chair of Climate and Sustainable Urbanization at the Paulson Institute

David Livingston, Associate in Carnegie’s Energy and Climate Program

Lindene Patton, Independent Consultant – Risk and Financial Services
The Risky Business Project
The Economic Risks of Climate Change in the United States

Kate Gordon
Vice Chair, Climate and Sustainable Urbanization
Goals and Project Approach

The Risky Business Project focuses on quantifying and publicizing the economic risks from the impacts of a changing climate.

- Led a nonpartisan, business-focused discussion on climate risk and the U.S. economy (convened by co-chairs Paulson, Bloomberg, and Steyer)

- Conducted an independent risk assessment
  - Rhodium Group research lead, RMS partner

- Undertook interdisciplinary research focusing on medium and long-term regional and sectoral impacts

- Assessed risk without dictating solutions

- Provided actionable data for public and private sector decision-makers to incorporate climate risk
The bottom line on climate change
Report Highlights: Coastal Risks

Sea Level Rise & Coastal Infrastructure

Current Property Value Below Mean Sea Level by 2050, billion USD

Current Property Value Below Mean Sea Level by 2100, billion USD

The bottom line on climate change
Without adaptation, some Midwestern and Southern counties could see yield declines in commodity crops of more than 10% over the next 5-25 years, with a 1-in-20 chance of yield losses more than 20% (by 2040).
Understanding Climate Risk

“Normal” weather distribution over time

Frequency of occurrence

Distribution range shifted by climate change

The new normal

The bottom line on climate change
Almost all Raters are currently incorporating climate change into their investment decisions, with 95% likely to continue in the future; Issuers and Investors are less likely to currently incorporate climate change (84% and 51%, respectively), but expect the likelihood to increase.
Investment Risk Factors - Investors

Climate change is a tertiary risk both when considering an overall portfolio and when considering a single investment.

**Q:** In thinking about your overall portfolio of investments, how concerned are you about each of the following types of risk?

<table>
<thead>
<tr>
<th>Overall portfolio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic/Market</td>
<td>71%</td>
</tr>
<tr>
<td>Legislative, Regulatory, Tax</td>
<td>56%</td>
</tr>
<tr>
<td>Business and Credit</td>
<td>55%</td>
</tr>
<tr>
<td>Competitive</td>
<td>52%</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>50%</td>
</tr>
<tr>
<td>Inflation/Deflation</td>
<td>47%</td>
</tr>
<tr>
<td>Political and Social</td>
<td>43%</td>
</tr>
<tr>
<td>Liquidity</td>
<td>41%</td>
</tr>
<tr>
<td>Legal</td>
<td>33%</td>
</tr>
<tr>
<td>Commodity price volatility</td>
<td>33%</td>
</tr>
<tr>
<td>Reinvestment</td>
<td>31%</td>
</tr>
<tr>
<td>Climate Change</td>
<td>30%</td>
</tr>
<tr>
<td>Currency/Exchange</td>
<td>29%</td>
</tr>
<tr>
<td>War and Terrorism</td>
<td>29%</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>21%</td>
</tr>
</tbody>
</table>

**Q:** How important is each of the following types of risk to your evaluation of a single long-term debt investment opportunity?

<table>
<thead>
<tr>
<th>Individual Investment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Rate</td>
<td>80%</td>
</tr>
<tr>
<td>Inflation/Deflation</td>
<td>71%</td>
</tr>
<tr>
<td>Economic/Market</td>
<td>69%</td>
</tr>
<tr>
<td>Business and Credit</td>
<td>63%</td>
</tr>
<tr>
<td>Legislative, Regulatory, Tax</td>
<td>50%</td>
</tr>
<tr>
<td>Liquidity</td>
<td>45%</td>
</tr>
<tr>
<td>Reinvestment</td>
<td>44%</td>
</tr>
<tr>
<td>Competitive</td>
<td>43%</td>
</tr>
<tr>
<td>Political and Social</td>
<td>40%</td>
</tr>
<tr>
<td>Currency/Exchange</td>
<td>37%</td>
</tr>
<tr>
<td>Commodity Price Volatility</td>
<td>34%</td>
</tr>
<tr>
<td>Legal</td>
<td>33%</td>
</tr>
<tr>
<td>Climate Change</td>
<td>30%</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>24%</td>
</tr>
<tr>
<td>War and Terrorism</td>
<td>24%</td>
</tr>
</tbody>
</table>

Summary of “very concerned” and “the one risk I am most concerned about” responses.

The bottom line on climate change.
Business Response – Climate Risks

A World Economic Forum survey of 900 members shows climate-related risks rank among the 10 top global risks for business and policy leaders.

### DISASTER PLANNING

**Top 10 Global Risks: Likelihood and Impact, 2015**

<table>
<thead>
<tr>
<th>MOST LIKELY</th>
<th>MOST IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interstate conflict</td>
<td>1. Water crises</td>
</tr>
<tr>
<td>2. Extreme weather events</td>
<td>2. Spread of infectious diseases</td>
</tr>
<tr>
<td>3. Failure of national governance</td>
<td>3. Weapons of mass destruction</td>
</tr>
<tr>
<td>4. State collapse or crisis</td>
<td>4. Interstate conflict</td>
</tr>
<tr>
<td>5. Unemployment or underemployment</td>
<td>5. Failure of climate-change adaptation</td>
</tr>
<tr>
<td>7. Failure of climate change adaptation</td>
<td>7. Critical information infrastructure breakdown</td>
</tr>
<tr>
<td>8. Water crises</td>
<td>8. Fiscal crises</td>
</tr>
<tr>
<td>9. Data fraud or theft</td>
<td>9. Unemployment or underemployment</td>
</tr>
<tr>
<td>10. Cyber attacks</td>
<td>10. Biodiversity loss and ecosystem collapse</td>
</tr>
</tbody>
</table>

Sources: BlackRock Investment Institute and World Economic Forum, September 2015.
Notes: The risk rankings come from the World Economic Forum (WEF)’s latest Global Risks Perception Survey, which polled 900 WEF stakeholders in the summer of 2014. Climate-related risks are highlighted.
Business Response – COP21

Almost 400 global business leaders joined the Lima-Paris Action Agenda Focus on Business at the Paris COP21, making commitments to climate action. These include:

- **Carbon-pricing**
  - 64 CEOs representing US$1.9 trillion in annual revenue commit to integrating carbon-pricing into long term strategies and investments

- **De-Carbonizing Assets**
  - 20 Investors commit to de-carbonization of assets totaling over US$600 billion

- **Climate Change Information**
  - Almost 30 institutional investment firms commit to include climate change information in their company reports

- **Climate Commitments**
  - Over 2000 companies and 4000 investors have registered climate commitments through the UNFCCC NÁZCA portal
American Business Act on Climate Pledge

In partnership with the White House, 13 of the largest American companies have committed to climate action measures that total at least $140 billion in new low-carbon investments and over 1,600 MW of new renewable energy.
One Industry’s Response: Reinsurance

Globally, the US $600 billion re-insurance industry is working closely with officials to better understand and integrate climate risks and encourage low-carbon investments.

The Climate Risk Statement released by the Geneva Association was signed by 68 leaders from the Global Reinsurance Industry representing over US $11 trillion in assets. It makes a commitment to strengthen the assessment of climate risk, to work side by side with political processes, and to supplement a wider framework of adaptation and risk reduction.
Businesses Invest in a Low Carbon Future

Bank of America issued its second green bond in May 2015 for $600 million, dedicated to renewable energy and energy efficiency projects, as part of its $70 billion environmental business commitment.

Since 2007, we’ve provided $39 billion in low-carbon financing*

- $12.7B Energy efficiency
- $3.3B Solar
- $1.5B Hybrid cars
- $918M Hydro
- $265M Geothermal
- $787M Biomass/biofuel
- $7.1B Mixed
- $4.5B Nuclear
- $3.5B Wind
- $2.5B Other
Next Steps for Risky Business: Blueprint Project

• Working with leading economic researchers, as well as business-leaders across the nation, the Risky Business Project plans to assess the economic and technical feasibility of reducing climate risks.

• Specifically, the project will look at transitioning towards an economy powered by clean energy in the near- to medium-term.

• A new report will provide specific and concrete illustrations of business and investment opportunities, infrastructure investments, and types of technology deployment that can drive a national transition to a clean energy economy.
Oil Sector Climate Risk

Towards Transparency and Analytical Strength

David Livingston

Decision Making & Climate Security Webinar | 27 Jan 2016
Our oil future is changing.

**YESTERDAY**
Proved Reserves 2000

1.3 trillion barrels  35 years remaining

- Light: 46%
- Condensates: 15%
- Heavy: 23%
- Extra Heavy: 8%
- Bitumen: 8%
Our oil future is changing.

**YESTERDAY**
Proved Reserves 2000

- 1.3 trillion barrels
- 35 years remaining

**TODAY**
Technically Recoverable Reserves 2012

- 6.5 trillion barrels
- 160 years remaining

**Comparison**

- Light: 46% vs. 20%
- Condensates: 15% vs. 6%
- Heavy: 23% vs. 6%
- Extra Heavy: 8% vs. 9%
- Bitumen: 8% vs. 20%

**Legend**

- Light
- Condensates
- Heavy
- Extra Heavy
- Bitumen
- Kerogen

**Additional Information**

- Each block represents 100 billion barrels of crude oil.
Our oil future is changing.

<table>
<thead>
<tr>
<th></th>
<th>YESTERDAY</th>
<th>TODAY</th>
<th>TOMORROW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proved Reserves</strong></td>
<td>1.3 trillion barrels</td>
<td>6.5 trillion barrels</td>
<td>24 trillion barrels</td>
</tr>
<tr>
<td><strong>35 years remaining</strong></td>
<td>35 years remaining</td>
<td>160 years remaining</td>
<td>500+ years remaining</td>
</tr>
</tbody>
</table>

**Yesterday**
- Light: 46%
- Condensates: 15%
- Heavy: 23%
- Extra Heavy: 8%
- Bitumen: 8%

**Today**
- Light: 20%
- Condensates: 6%
- Tight: 6%
- Heavy: 16%
- Extra Heavy: 9%
- Bitumen: 20%
- Kerogen: 23%

**Tomorrow**
- Light: 10%
- Condensates: 6%
- Tight: 6%
- Heavy: 10%
- Extra Heavy: 5%
- Bitumen: 11%
- Kerogen: 13%
- Gas to Liquids: 12%
- Coal to Liquids: 18%

Each block represents 100 billion barrels of crude oil.
Where Are They?

- Oil 2.0
- Ultra-deep Oils
- Tight Shale Oils
- Tar/Oil Sands (Bitumens)
- Extra-heavy Oils
- Oil Shale (Kerogen)
- Natural Gas Liquids
- Condensates
- Heavy Oils
- More Hydrocarbon Substitutes
All Oils Are Not Created Equal

Developed Oil Climate Index
KNOW YOUR OIL

CREATING A GLOBAL OIL-CLIMATE INDEX
Comparing Barrel-Forward GHGs

Interactive Web Tool for Assessing Oils’ Changing Climate Footprints

Explore the Oil-Climate Index

OCI.CarnegieEndowment.org
Supply chain emissions vary by oil. And emissions are hidden in different processes.
OCI Overall: Phase 1 Results

80% GHG difference between lowest and highest oil in Phase 1

Source: Authors’ calculations
Note: Unlike the other OCI test oils, Cold Lake dilbit is not composed of a full barrel of oil.
Different Oils, Different GHGs

Carnegie Oil Climate Index Estimated GHG Emission Ranges for 30 Phase 1 Test Oils

Notes: “x” represents average GHG emissions for OCI test oils in each oil category. Extra-heavy oil includes oil sands.
Oil Economics vs. GHG Impacts

Upstream Production Costs

If carbon isn’t priced (explicitly or implicitly), BAU won’t consider the climate.
Vehicle emissions vary by oil source.

Low GHG Oil
470 kg CO$_2$e/bbl

Car
40 mpg

28 tons CO$_2$e

High GHG Oil
800 kg CO$_2$e/bbl

SUV
20 mpg

56 tons CO$_2$e

Grey square represents vehicle lifetime GHG emissions.
Role for Informed Decisions

Downstream Product Values

Current market incentives to combust carbon

Market Value Versus GHG Emissions for 30 Phase 1 OCI Test Oils

Source: Authors’ calculations
Note: Petcoke prices are from 2014; all other prices are from 2015.
Thank You!

OCI.CARNEGIEENDOWMENT.ORG
Decision Making: Why Climate Risk Is Relevant to Business

How tools, credit risk, litigation and regulations are changing the paradigm for business

Lindene Patton
27 January 2016
Definitions

- Are they important?
  - Resilience
  - Climate
  - Climate change
  - Extreme weather

- Or is the Impact / Risk Management the real starting point?
Extreme Weather Event Impacts - on the Rise

FIGURE 1

Number of Federal Major Disaster Declarations by Administration

<table>
<thead>
<tr>
<th>YEARLY AVERAGE</th>
<th>REAGAN</th>
<th>H.W. BUSH</th>
<th>CLINTON</th>
<th>G.W. BUSH</th>
<th>OBAMA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23</td>
<td>39</td>
<td>47</td>
<td>57</td>
<td>65</td>
</tr>
</tbody>
</table>

FIGURE 2

Loss Events in the U.S. by Decade

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66</td>
<td>96</td>
<td>155</td>
</tr>
</tbody>
</table>

FIGURE 3

Loss Events in the U.S. by Decade

Overall and Insured Losses

Vast Majority of Federal Funds Are Reactive

Pre-disaster Mitigation Allocations and Hazard Mitigation Grant Program Estimated Awards from Fiscal Years 2011-2014

- 94% for Hazard Mitigation Grant Program: $3,237,089,523
- 6% for Pre-Disaster Mitigation: $222,953,658

Source: GAO analysis of FEMA data | GAO-15-515

Economic Resilience

- climate risks assessments;
- resiliency standards

- planning and investments
  - supply chain,
  - workforce; and
  - Infrastructure

- All relevant to Economic Sustainability and Competitiveness
Challenges

- Lack of traditional ‘demand’
- Procurements regulations and law – stuck in the ‘70s, ‘80s and ‘90s ... leading to ...
- Administrative actions
- Litigation
- Placing licensed professionals, utilities and government officials between a ‘rock and a hard place’
Climate Risk Management

- New Tools
  - Risk scores
  - Hazard Scores
  - Impact Modeling

- Developments in Climate and Attribution Science

All are relevant to Risk Management
Regulatory ‘Demand’

- Inconsistent
- Patchwork
- Differs by industry
- Differs by government agency
- Differs by geography
- No common theme or priority

- Conflict of laws
- Environment for potential litigation
Procurement Regulations: Create Conflicts of Law

- Roads / Transportation
- Electric Utilities
- Water
- Waste Water
- Other
  - Army Corps
  - DOD
  - DOE
  - etc.

Example: procurement rules that reference 1970’s vintage rainfall tables as the determinative rainfall amount reference for design criteria – see Farmers case next slide
In April 2014, Farmers Ins. Co. filed nine class-action lawsuits arguing that local governments in the Chicago area are aware that climate change is leading to heavier rainfall but failing to prepare accordingly. See, e.g., Illinois Farmers Insurance Co. v. Metro Water Reclamation District of Greater Chicago.

Farmers requested class certification to represent all property insurance companies, affected policyholders, and other affected property owners in connection with severe rains that hit the Chicago area on April 17, 2014.

The suits alleged a novel theory of liability and duty of care regarding climate change projections, namely that the Defendants (i) breached their duty to store storm water safely and to remedy property damage from the resulting flood and (ii) were responsible for flood damage caused by the overflowing storm basins.

The Defendants allegedly determined the capacity needed to avoid floods with historical data that did not account for the effects of climate change. Since the climate change projections indicate greater rainfall than in the past, the Defendants had a duty to plan for the increase.
Administrative Actions
(example – leading to costs)

- Post Sandy
- Utility rate case: in the matter involving ConEd, as in many involving consumer protection regulation, there is a tension between the desire to keep costs low for ratepayers and the need to (re)construct with sufficient resilience to handle expected extreme weather events in the face of climate change
- Post-event reconstruction cost
- Cost: Millions of dollars; >1 year of delay
- Result: The Storm Hardening and Resiliency Collaborative; see
Litigation (Example)

- In November 2015, the New York Attorney General issued a subpoena to ExxonMobil allegedly demanding documents dating back to 1977 related to climate change, including research related to the causes and effects of climate change.
- If prior actions against Dynegy, Xcel, AES and Peabody are predictive of the future outcomes from the ExxonMobil subpoena, some additional disclosures related to potential climate related regulatory impacts to the companies may be had, but actual discussion of the science and knowledge about climate change will be avoided.
Credit Drivers

- Climate Change Will Likely Test The Resilience Of Corporates' Creditworthiness To Natural Catastrophes, Standard & Poors; APRIL 20, 2015 1394564 | 301967406
- Standard and Poor’s Rating Services “Simulated Natural Catastrophe Impacts”, September 2015
How Development in Climate and Attribution Science is Relevant

- Certainty of climate science
  - IPCC (2013)
  - US NCA (2014)
- Attribution – science improvements / ongoing
  - BAMS Supplement Explaining Extreme Weather Events / Attribution – 2012-2015
  - “world weather attribution project"
  - EUCLIEA
  - climateprediction.net
  - Weather@home
- Damages Allocation Theory
Tools / Opportunities

- Multi-decade decline in the use of private industry financial risk assessment and risk spreading tools,
- Natural catastrophe financial modeling and analytic tools have improved significantly over the last three decades
- Work remains to make them useful for application outside insurance
  - tools are designed to assess risk for instruments with a 1-3 year tenor.
  - Extending those tools to apply to instruments and assets with tenor and amortizations schedules ranging from 7 to 15, 30, 50 or 100 years will require adjustments to the models themselves. (Lloyds 2012)
Climate: Another Milestone

2015 WAS OUR PLANET’S HOTTEST YEAR ON RECORD

Temperature Difference from 20th Century Average (°F)

Decade average:

-1.0°F
-1.5°F
-2.0°F
-2.5°F
-3.0°F
-3.5°F
-4.0°F
-4.5°F
-5.0°F
-5.5°F
-6.0°F
-6.5°F
-7.0°F
-7.5°F
-8.0°F
-8.5°F
-9.0°F
-9.5°F
-10.0°F

It’s time to ActOnClimate

WH.gov/Climate
What does Winter Storm Jonas look like from space?

Jan. 23, 2016, RapidScat, 100 mph winds along New Jersey
Credit: NASA JPL, Doug Tyler

MODIS instrument on Aqua Satellite
January 24, 2016
Credits: NASA Goddard MODIS Rapid Response

Operational Land Imager (OLI) on Landsat 8
Maryland, Virginia, and DC, January 24, 2016
Credits: USGS/NASA Earth Observatory/Joshua Stevens/Mike Carlowicz
Earth Observations

• Getting the data and information when you need it;
• The role of the private sector; and
• Recognizing a broader community of stakeholders.
“What should the rest of us do? Two things come to mind. First, we should brace for change. It is inevitable...Second, we should be prepared to absorb these with appropriate sang-froid. Some will be more difficult to deal with, like rising seas, but many others could be positive...”

Piers J. Sellers
Cancer and Climate Change
January 6, 2016
The New York Times
Questions
Decision Making and Climate Security for Business

Nancy Colleton
nancy_colleton@strategies.org

Kate Gordon
kgordon@paulsoninstitute.org

David Livingston
dlivingston@ceip.org

Lindene Patton
lindene1@verizon.net

Clark Miller
Clark.Miller@asu.edu
Upcoming Webinars

SSF Webinar Schedule
Register at: www.ssfonline.org

SSF /ASU Webinars Coming Up:

• [Global Governance in the Face of Non-Traditional Risk](#) – February 18th, 2016

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