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Better Buildings®
U.S. DEPARTMENT OF ENERGY

Perspectives on Resilience: Insurance and Credit Underwriting

February 9, 2021

3:00 – 4:00 pm EDT

U.S. DEPARTMENT OF ENERGY

Joe Indvik

RE Tech Advisors

Agenda

1. Topic and Speaker Introduction
2. Speaker Presentations
3. Audience Q&A
4. Closing Remarks

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Today's Themes

Finance and Resilience Initiative

Need:

Building owners looking for guidance on where to start on resilience as climate and weather disasters intensify and market pressure increases.

Goal:

Bring together experts and emerging best practices to help building owners measure, manage, and mitigate resilience risk. Focus on energy and climate, with other areas considered.

Activities:

- Roundtable of industry experts from CRE, finance, and insurance industries
- Develop actionable resources
- Share insights with the market

Steps Toward Resilience

Resilience Roadmap on the Solution Center

Steps to Resilience

1. BUILDING THE FINANCIAL BUSINESS CASE FOR RESILIENCE

This fact sheet introduces the Resilience Roadmap and reviews key concepts including the challenges of resilience, understanding and measuring risk, and how to quantify and articulate the financial business case for resilience improvements.

2. MANAGING INSURANCE COST AND BUSINESS RISK

This fact sheet discusses the role that the insurance industry plays in mitigating resilience risk and offers best practices for building owners to work effectively with insurers.

3. FINANCING AND IMPLEMENTING RESILIENCE PROJECTS

This fact sheet discusses implementing resilience improvements across a commercial building portfolio and evaluating financing options that can help overcome upfront costs and other common barriers to resilience.

Resources & Case Studies

Figure 1: Physical and Transition Risks from Climate Change

Category	Potential impact
Physical risks	
Catastrophic events	Extreme weather such as hurricanes an
Changes in weather patterns	Gradual changes in temperature and pre higher temperatures, rising sea levels, in heavy rain and wind, and decreased rain to exaggerate the impact of catastrophic
Transition risks	
Market	The possibility that markets vulnerable t become less desirable over time. Rising for building and maintaining infrastructu climate risks.
Policy and regulation	Regulations to address climate change— disclosure, tougher building standards, c emissions caps, changes to subsidies— policies for providing funding for infrastr after major events.
Resource availability	Changes in the availability of key resour and water, including water scarcity.
Reputation and market position	Growing stakeholder preference to work incorporating climate risk into investmen consumer preference for real estate pro climate mitigation.

Source: https://europe.uli.org/wp-content/upl

Measuring resilience risk accurat
Materiality is an accounting conc
omitted from a financial statemen
asset or portfolio are most susce
interruptions or losses could be.
Disclosures (TCFD) are beginnin

Learn more at betterbuildingssol

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Financing and Implementing Resilience Projects

Executive Summary

A wide range of technologies, management practices, and financing solutions are available to help building owners improve the resilience of their properties. This fact sheet defines common resilience improvements and provides key considerations for identifying, prioritizing, and implementing these improvements across a commercial building portfolio. It also discusses common barriers to resilience improvements and reviews various third-party financing solutions that can help overcome these barriers.

Overview

Resilience projects in commercial buildings typically take the form of retrofits that improve the envelope, structure, or systems of the property. During natural disasters, energy and electrical power availability is one of the more vulnerable aspects of building operation, so these improvements often aim to make building energy systems more robust, independent, and/or efficient.

Most resilience projects can be divided into three categories, shown in the box. **Energy Supply** projects help ensure that critical building systems can continue operating during a grid or fuel supply interruption. **Resource Conservation** projects reduce the energy and water demands of a building, increasing the amount of time it can operate on backup power and reducing the impact of disruptions. **Structure Hardening** projects mitigate property damage, injury, and system outages in the event of disaster.

COMMON RESILIENCE PROJECTS

Energy Supply
- Renewable energy
- Combined heat and power (CHP)
- Battery storage
- Backup generation
- Microgrid
- Electric vehicle charging

Resource Conservation
- Efficient lighting and HVAC
- Water efficiency measures
- Building envelope improvements

Structure Hardening
- Seismic retrofits
- Wind-resistant roofs and windows
- Flood mitigation

Some building owners—particularly those with shorter hold periods—do not consider climate and resilience impacts to be a short-term risk, though that sentiment is beginning to change. Many resilience projects have high upfront costs of implementation, and some projects may not have a simple payback that is within an owner's hold period. However, calculations of the simple payback of resilience often do not include factors such as avoided damage costs, increased marketability and safety, insurance premium reductions, ability to attract competitive investment, and other financial aspects that may be less obvious.

Implementing Resilience Improvements

Building owners may benefit from adopting a systematic opportunity assessment process to identify potential resilience improvements at individual assets and across the portfolio. This may take the form of a checklist, site visits, property team interviews, or other strategies to collect information on the state of resilience-related practices, technologies, and structural considerations in an easily comparable way. In addition to existing buildings, many building owners have also implemented a due diligence process for evaluating these risks and opportunities for new properties that come into the portfolio through new acquisitions and new developments, as well as major renovations.

Once the risks and opportunities are determined, building owners should screen and prioritize potential improvements. A first step may be to determine the most at-risk properties in terms of:

Learn more at betterbuildingssolutioncenter.energy.gov

U.S. DEPARTMENT OF ENERGY

Available at: https://betterbuildingssolutioncenter.energy.gov/finance-resilience

Today's Presenters

Yoon Kim
Four Twenty Seven

Ben Harper
Zurich

Paul Mathew
Lawrence Berkley National Lab

Yoon Kim

Four Twenty Seven

Four Twenty Seven

ESG & CLIMATE RISK

Climate Risks for Real Estate

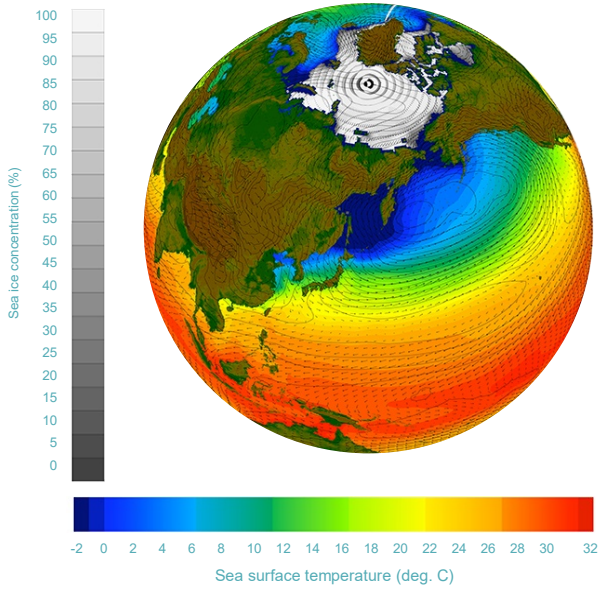
DOE Better Buildings Webinar

Yoon Kim

February 9, 2020

About Four Twenty Seven

- Four Twenty Seven, an affiliate of Moody's, is the leading provider of data and analytics on the physical risks associated with climate change.
- Established in 2012, we are headquartered in Berkeley, CA, with offices in Washington DC, Paris and Tokyo and representatives in London and Sydney.
- We translate climate models into actionable intelligence for our clients, which include some of the world's largest investors, asset managers, commercial banks, development finance institutions, corporations and government agencies.



http://427mt.com/insights/

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Physical and Transition Climate Risks

Source: Muthengi Mbuvi, https://unsplash.com/s

- Physical Risks
  - Acute – Extreme events such as floods, storms, droughts, wildfires
  - Chronic – Longer-term, slower-onset changes such as rising temperatures and rising sea levels

Source: Kouji Souru, https://unsplash.com/s

- Transition Risks
  - Policy actions
  - Legal risk
  - Technology risk
  - Market risk
  - Reputation risk

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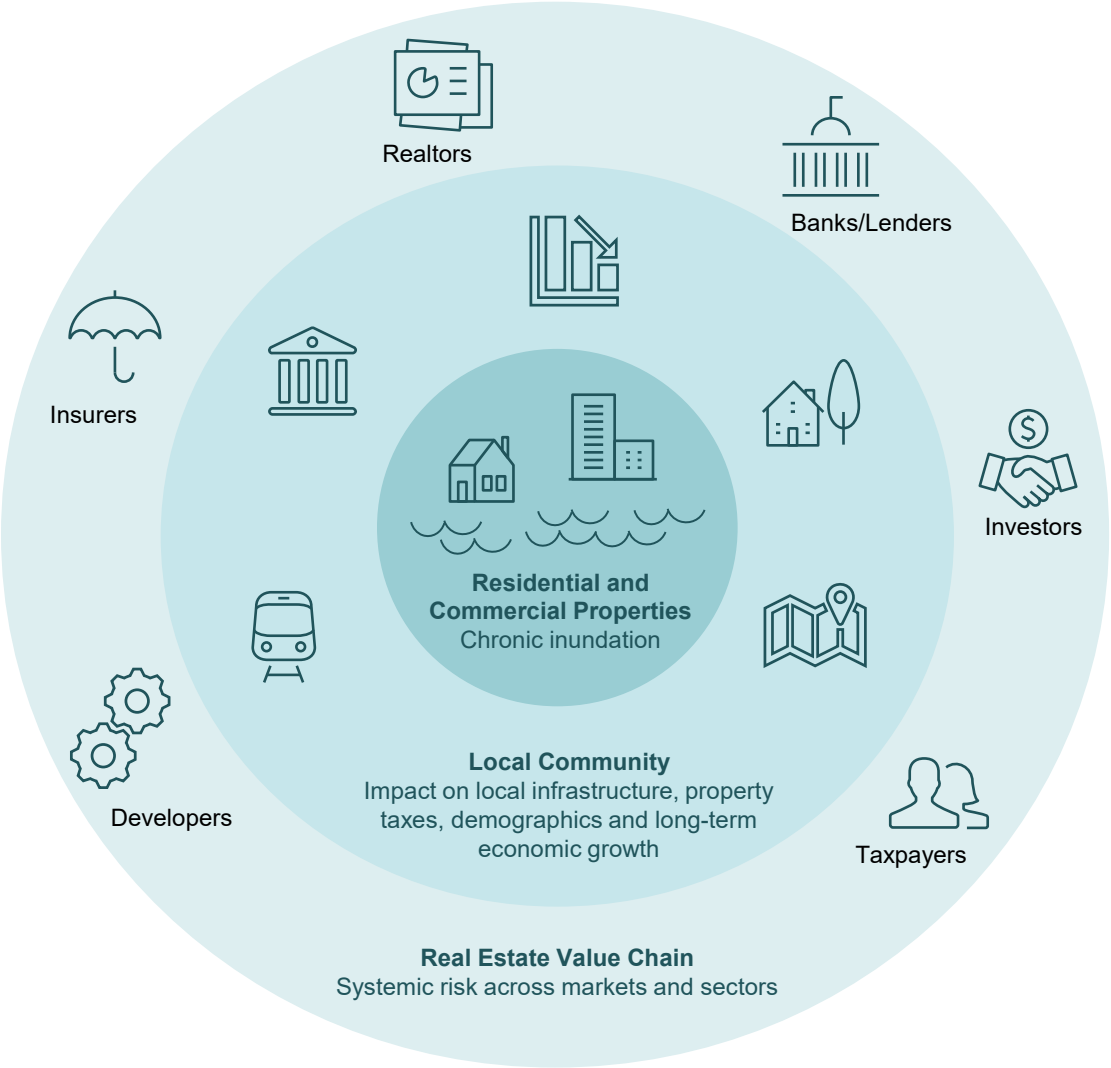
Climate Impacts on Real Estate Markets: Sea Level Rise



Source: Union of Concerned Scientists, Four Twenty Seven

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+ Climate Risk as Financial Risk

The News&Observer

Sea level rise has already sunk Carolinas beach property values — by $1.6 billion, study finds

BY ABBIE BENNETT

JULY 25, 2018 08:30 AM, UPDATED JULY 25, 2018 07:44 PM

Source: The News & Observer, July 25, 2018
(https://www.newsobserver.com/news/technology/article215476785.html)

The New York Times

Climate and Environment › | Summer Weather | Trump's Changes | Climate 101 | Is Your Hometown Hotter? | Newsletter

Rising Seas Threaten an American Institution: The 30-Year Mortgage

Climate change is starting to transform the classic home loan, a fixture of the American experience and financial system that dates back generations.

Homes in Nags Head, N.C., as Hurricane Florence approached in September 2018. Steve Helber/Associated Press

By Christopher Flavelle

June 19, 2020

Source: The New York Times, June 19, 2020
https://www.nytimes.com/2020/06/19/climate/climate-seas-30-year-mortgage.html

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Growing Market Recognition of Climate Change as a Material Financial Risk

MarketWatch · Latest Watchlist Markets Investing Barron's Personal Finance Economy Retirement Co

Home > Economy & Politics > Federal Reserve

Climate change poses a 'systemic threat' to the economy, investors with $1 trillion at stake warn the Fed and SEC

Published: July 22, 2020 at 9:21 a.m. ET

By Rachel Koning Beals

Pension funds and other big investors want regulatory help on climate-change risk

Source: https://www.marketwatch.com/story/climate-change-poses-a-systemic-threat-to-the-economy-investors-with-1-trillion-at-stake-warn-the-fed-and-sec-2020-07-21

BlackRock CEO Larry Fink's 2021 letter to CEOs

A Tectonic Shift Accelerates

In January of last year, I wrote that climate risk is investment risk. I said then that as markets started to price climate risk into the value of securities, it would spark a fundamental reallocation of capital. Then the pandemic took hold – and in March, the conventional wisdom was the crisis would divert attention from climate. **But just the opposite took place, and the reallocation of capital accelerated even faster than I anticipated.**

From January through November 2020, investors in mutual funds and ETFs invested $288 billion globally in sustainable assets, a 96% increase over the whole of 2019.[1] I believe that this is the beginning of a **long but rapidly accelerating transition** – one that will unfold over many years and reshape asset prices of every type. **We know that climate risk is investment risk. But we also believe the climate transition presents a historic investment opportunity.**

Source: https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter

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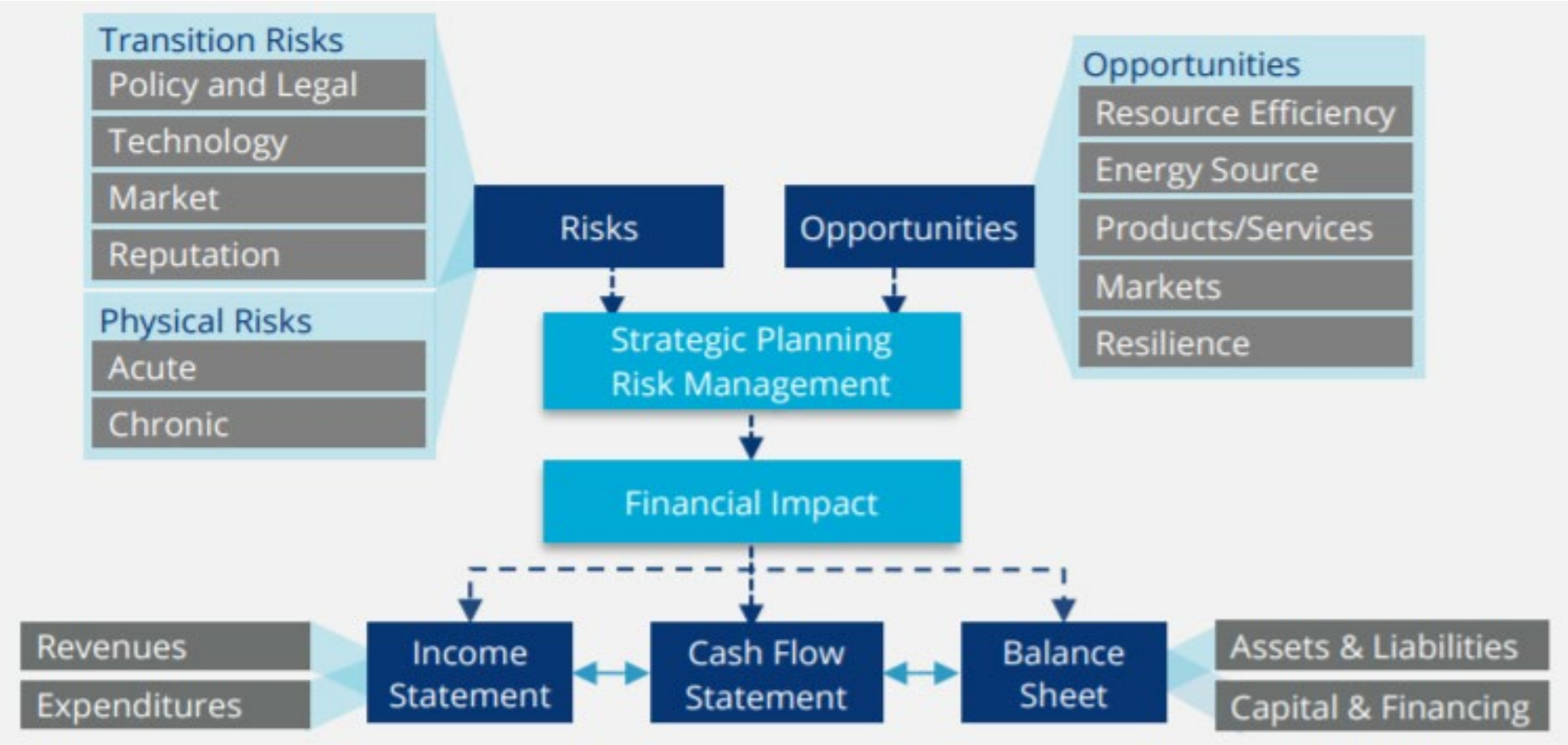
Task Force on Climate-related Financial Disclosures



Source: TCFD (2017), Final Recommendations Report

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Increasing Regulatory Attention in the US

REUTERS

World Business Markets Breakingviews Video More

ENVIRONMENT FEBRUARY 8, 2021 / 11:23 AM / UPDATED AN HOUR AGO

Fed to weave 'inescapable' climate change risk into bank oversight

By Reuters Staff 3 MIN READ

SAN FRANCISCO (Reuters) - The U.S. Federal Reserve is beginning to incorporate the impacts of global warming into its regulatory writ, following in the footsteps of its global peers, according to a paper published Monday by the San Francisco Fed.

News Release

FHFA Issues RFI on Climate and Natural Disaster Risk Management at the Regulated Entities

FOR IMMEDIATE RELEASE

1/19/2021

FINANCE

'Enormously big deal': Fed creates climate committee

Avery Ellfeldt, E&E News reporter

Published: Tuesday, January 26, 2021

The Federal Reserve announced yesterday the creation of a first-of-its-kind committee to deepen the central bank's understanding of the risks that climate change poses to the financial system.

Sources:https://www.reuters.com/article/us-usa-fed-climate-idUSKBN2A828A, https://www.fhfa.gov/Media/PublicAffairs/Pages/FHFA-Issues-RFI-on-Climate-and-Natural-Disaster-Risk-Management-at-the-Regulated-Entities.aspx, Climatewire, January 26, 2021

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Integration in Credit Risk Research and Ratings

ESG – Global

2021 outlook – Stimulus, transparency and policy alignment to amplify ESG trends

As the global economy recovers from the coronavirus pandemic, environmental, social and governance issues will assume greater importance in the actions of policymakers, regulators, investors and corporate decisionmakers. The increasing interaction of these issues will amplify their impact on credit quality, while the positive credit implications of being well-positioned to adapt to ESG trends will become more apparent.

Source: Moody's Investor Services
ESG Global Outlook. February 3, 2021.

MOODY'S INVESTORS SERVICE — STRUCTURED FINANCE

Appendix: Top 10 loan summaries

1. The Chase Center Towers

Collateral summary	
% of pool	15.8%
Pool amount	$101,250,000
Originator	JPMCB
Structured Credit Assessment	a2 (sca.pd)
Property type	Office - CBD
Location	San Francisco, CA
Red-Yellow-Green™	Yellow (36.9)
Size	566,208 SF
Year built/Renovated	2019 / NAP
Occupancy	100% as of 05/10/2020
Ownership	Fee Simple
Purchase price	N/A

Loan summary	
Loan type	Fixed
Interest rate	3.5220%
Interest-Only period	59 months
Amortization	Interest-Only
Maturity date	3/10/2025
Sponsor	GSW Sports LLC; Uber Technologies, Inc.; Alexandria Real Estate Equities, Inc

Structural features	
Lockbox	Hard / Springing
Ongoing reserves	Monthly: Taxes (Springing); Insurance (Springing); Replacement (Springing); TI/LC (Springing); Outstanding TI's ($0); Outstanding Repairs ($0)
Upfront reserves	Taxes ($0); Insurance ($0); Replacement ($0); TI/LC ($0); Outstanding TI's ($47,514,546); Outstanding Repairs ($15,163,800)

Third party summary				
Report	Vendor	Date	Issues	Note
Appraisal	CBRE	12/19/2019	No	1
Environmental	Partners	10/11/2019	No	1
Engineering	Partners	10/11/2019	No	1
Seismic	Partners	11/7/2019	No	1

Notes:
1. No significant issues.
2. S&L: 20%; S&L: 14%

Debt summary		Moody's LTV	Moody's DSCR
Pool balance	$101,250,000	65.3%	3.65x
Pari passu balance	$168,750,000	65.3%	3.65x
B-Note & C-Note	$330,000,000	145.1%	1.09x
First mortgage balance	$600,000,000	145.1%	1.09x
Mezzanine	$0	145.1%	1.09x
Total	$600,000,000	145.1%	1.09x

Collateral photo

Source: Term sheet

CMM metrics

Probability of default: 0.4%

Four Twenty Seven physical climate risk			
Climate Hazard	Risk Level	Site Score	Country Benchmark
Floods	Low	7	17
Heat Stress	Medium	39	44
Hurricanes & Typhoons	None	0	18
Sea Level Rise	Red Flag	80	6
Water Stress	High	61	45

Note: refer to appendix for explanation of Four Twenty Seven climate risk scores

Benchmark 2020-IG2 Mortgage Trust: Pre-Sale – $639.1 million CMBS large loan transaction

Four Twenty Seven physical climate risk			
Climate Hazard	Risk Level	Site Score	Country Benchmark
Floods	Low	7	17
Heat Stress	Medium	39	44
Hurricanes & Typhoons	None	0	18
Sea Level Rise	Red Flag	80	6
Water Stress	High	61	45

Source: Moody's Investor Services – Credit Opinion: Benchmark 2020-IG2 Mortgage Trust. May 11, 2020

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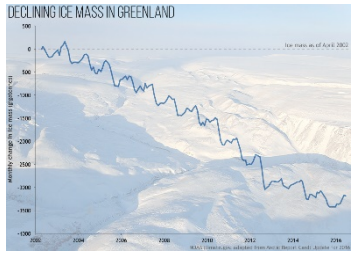
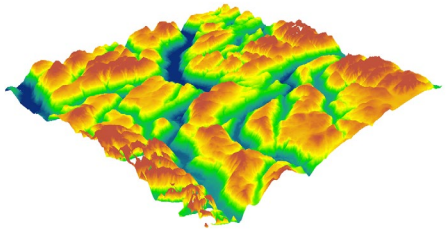
Using Climate Science for Investment Decisions

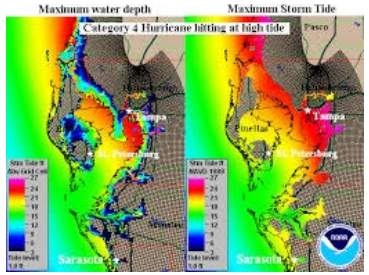


Air, ocean, and ice (including cliff) dynamics

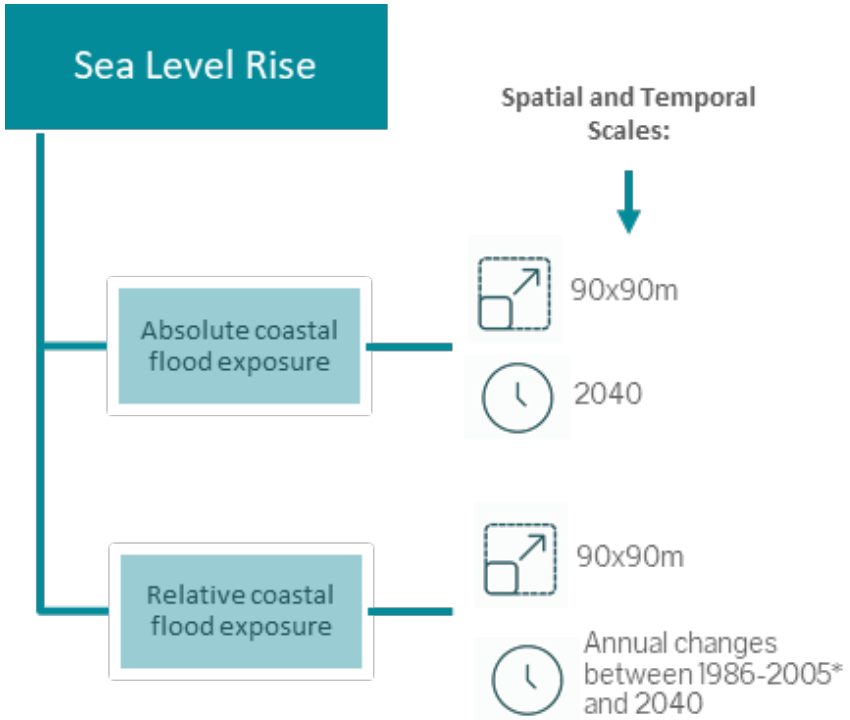


Elevation data (SRTM)

Historical sea levels and subsidence



Tidal gauge data for storm surge



Source: Four Twenty Seven

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Assessing Climate Risk for a Property

Asset Scoring - Form

* Facility Name:	Moody's Headquarters
Street Address 1:	7 World Trade Center
Street Address 2:	
City:	New York
State/Province:	
Postal Code:	
* Country:	USA
* Activity:	Office
Latitude:	
Longitude:	

Map Location | Calculate Score | Reset

Moody's New York Office

Scorecard | CSV

Address: 1 World Trade Center, New York, NY, USA
Coordinates: (40.71125, -74.01442)
Activity: Office

	Category	Risk Level	Category Score	Country Benchmark
+	Earthquakes	None	0	22
+	Floods	Low	6	20
+	Heat Stress	High	45	45
+	Hurricanes & Typhoons	Low	39	23
−	Sea Level Rise	Red Flag	80	6

Subcategory	Measure	Unit	Subcategory Score	Country Benchmark
Absolute Coastal Flood Frequency		Return Period of Inundation	100	6
Relative Coastal Flood Frequency		Factor of change	60	6

+	Water Stress	High	60	46
−	Wildfire	Low	43	64

Subcategory	Measure	Unit	Subcategory Score	Country Benchmark
Burnable Fuel Availability	Medium	Percent		
Change in days with high wildfire potential	0.00	Difference in high risk days	0	35
Change in maximum wildfire potential	34.97	Difference in KBDI	50	61
Days with high wildfire potential	0.00	High risk days	0	31
Maximum wildfire potential	126.48	KBDI	40	53

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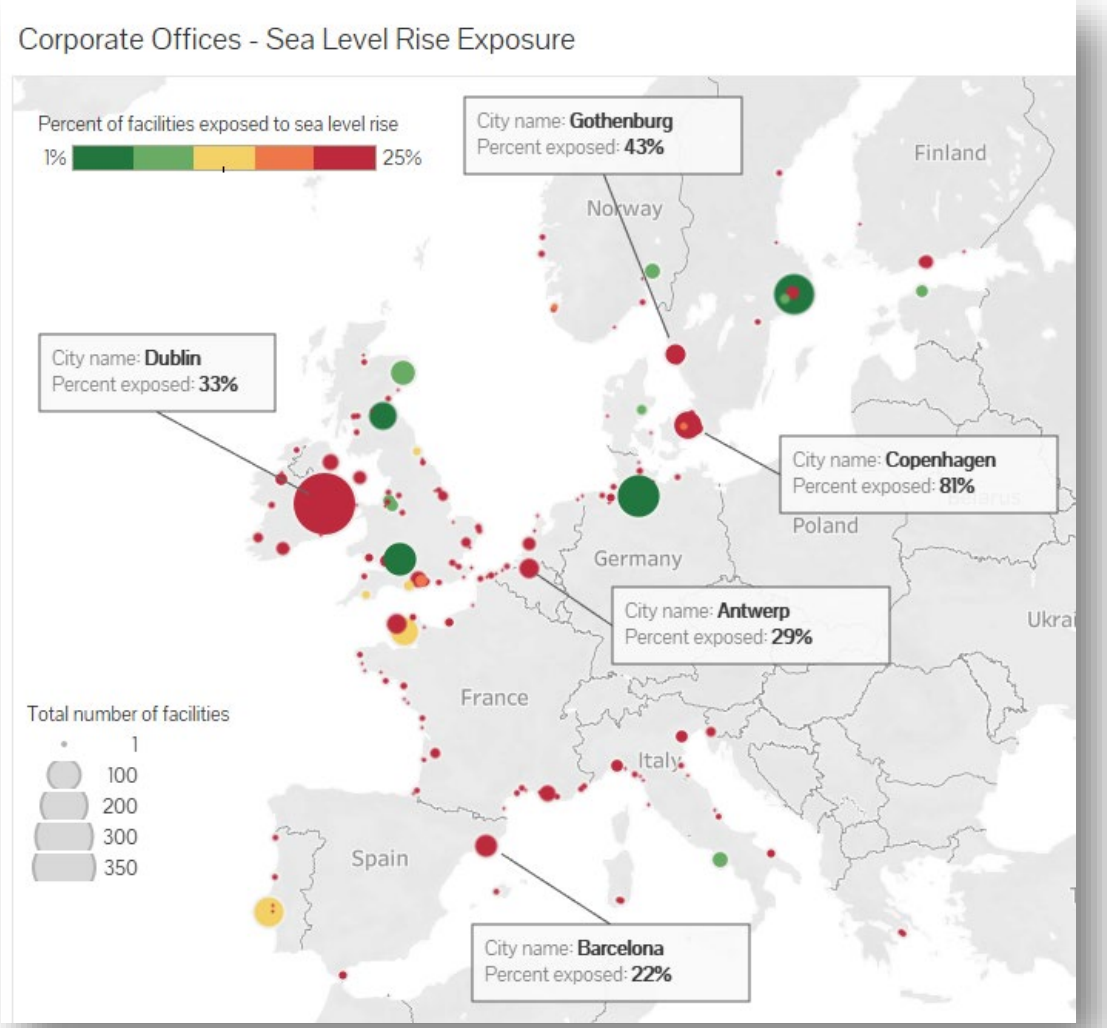
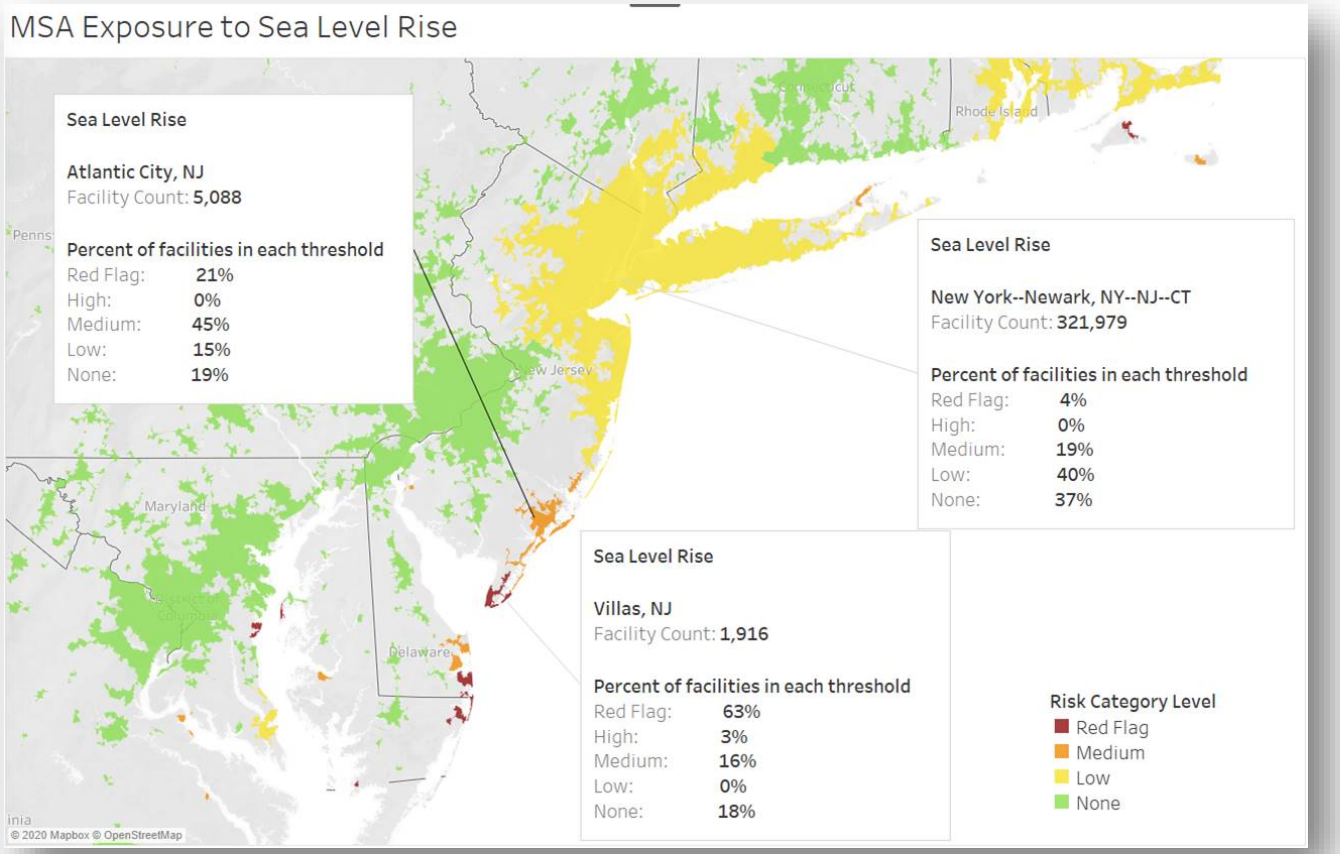
Market Exposure to Sea Level Rise



Source: Four Twenty Seven (September 2019)
http://427mt.com/2019/09/06/real-estate-climate-risks-how-europe-will-be-impacted/



Source: Moody's Analytics REIS, Four Twenty Seven

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Four Twenty Seven

ESG & CLIMATE RISK

Yoon Kim
Head of Global Client Services,
Moody's ESG
ykim@427mt.com

Ben Harper

Zurich

ZURICH

Perspectives on Resilience Underwriting for a Sustainable Future

Ben Harper
Head of Corporate Sustainability

February 2021

Confidential \ Non Personal Data

Definitions

Sustainability means doing business today in a way that safeguards our future in the face of a transforming society.

Resilience is the practice of designing things to endure physical, social and economic shocks and stresses

Environmental, Social, and Governance (ESG) refers to the three central factors in measuring the sustainability and societal impact of a company or business

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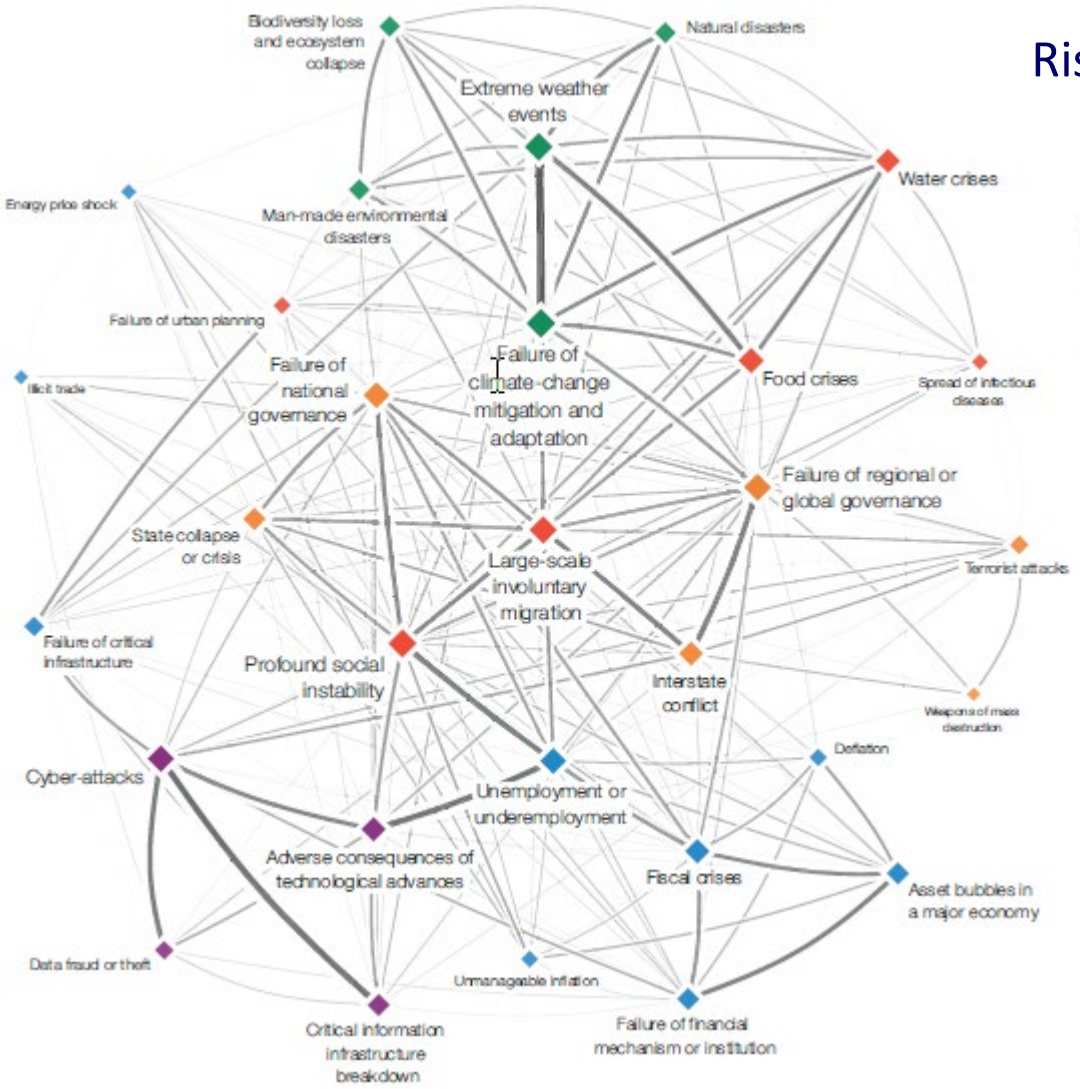
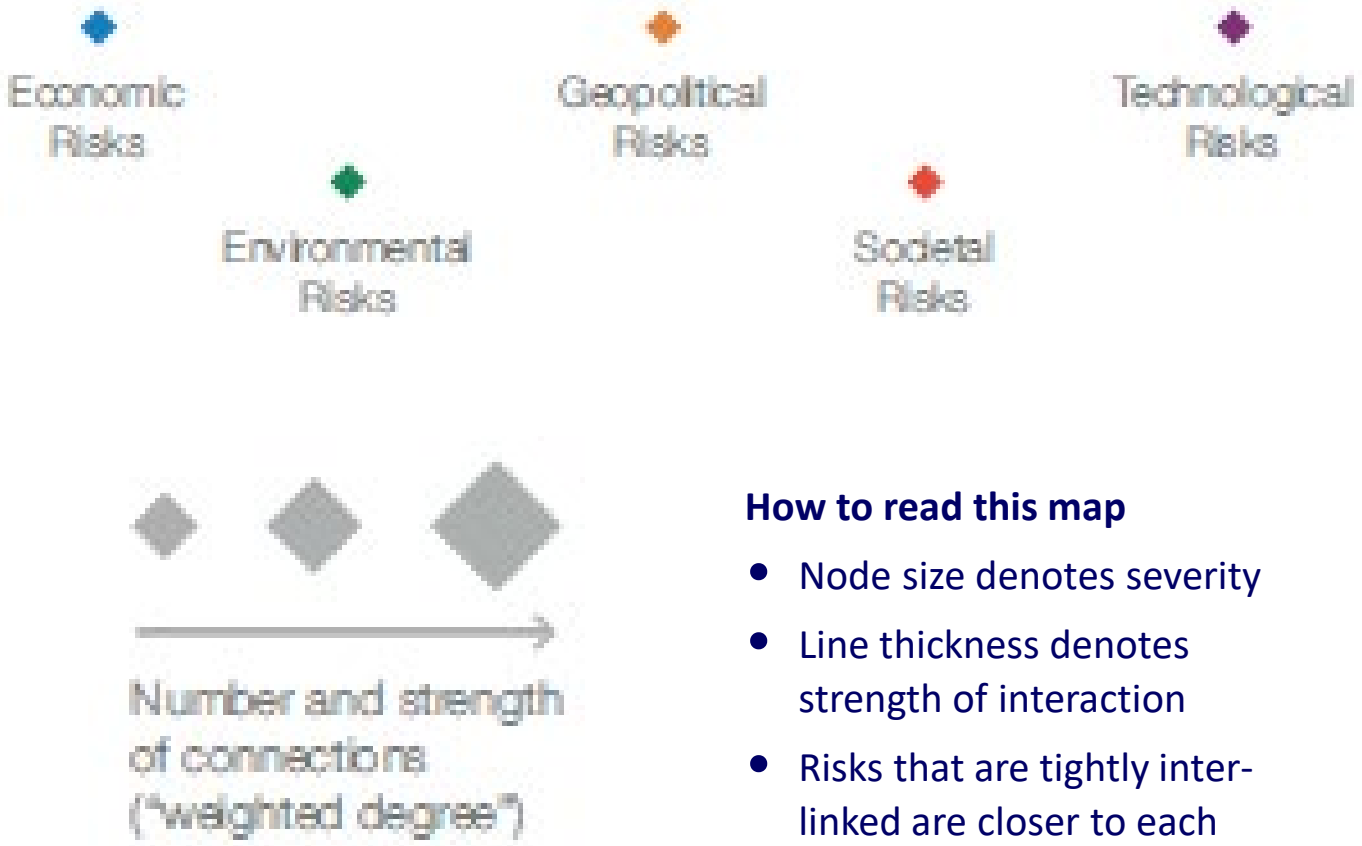
Perspectives on Resilience
Interconnected Nature of Risks

ZURICH



Risk Network effects – Risks Interconnection Map 2019



How to read this map

- Node size denotes severity
- Line thickness denotes strength of interaction
- Risks that are tightly inter-linked are closer to each other

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Source: WEF Global Risk Report 2019 / Zurich

Perspectives on Resilience Insurance Products

Sustainability Risk Potential Coverages

Property Risks (commercial and personal lines)

- damage to structure
- damage to land
- infrastructure damage
- displacement
- etc.

Non-Traditional Risks (commercial)

- Natural resource damages
- Business interruption
- Trespass
- Loss of income
- Cultural resource damages
- Pollution
- Supply chain interruptions
- Director & Officers

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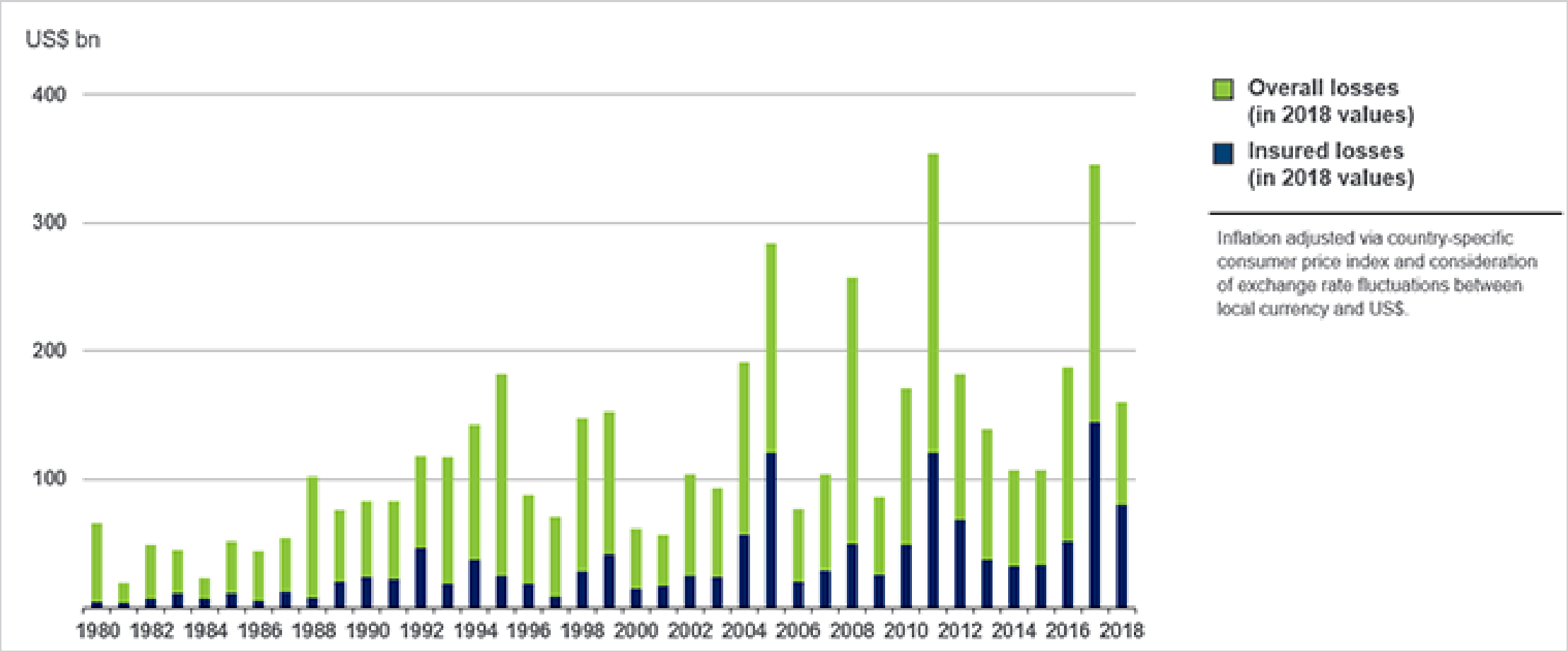
Perspectives on Resilience
Worldwide Natural Disasters



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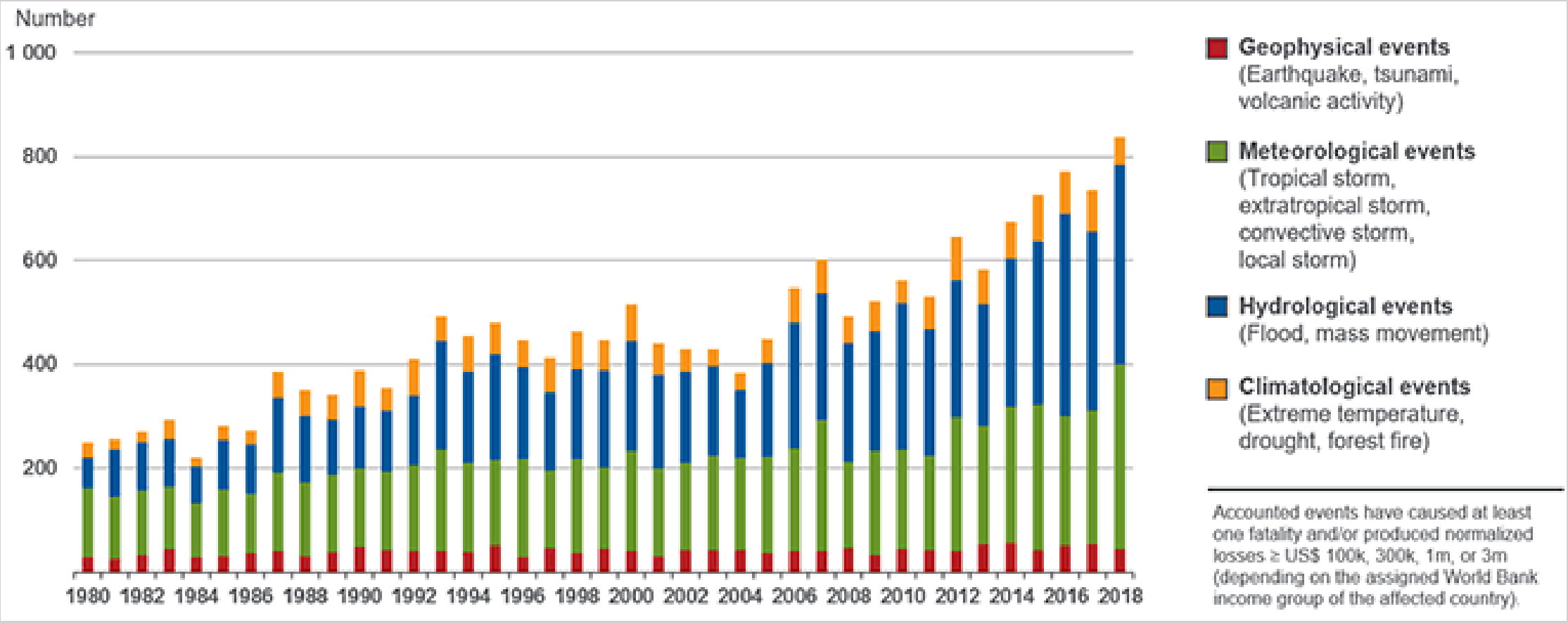
Source: MR NatCatSERVICE

Perspectives on Resilience
Worldwide Natural Disasters



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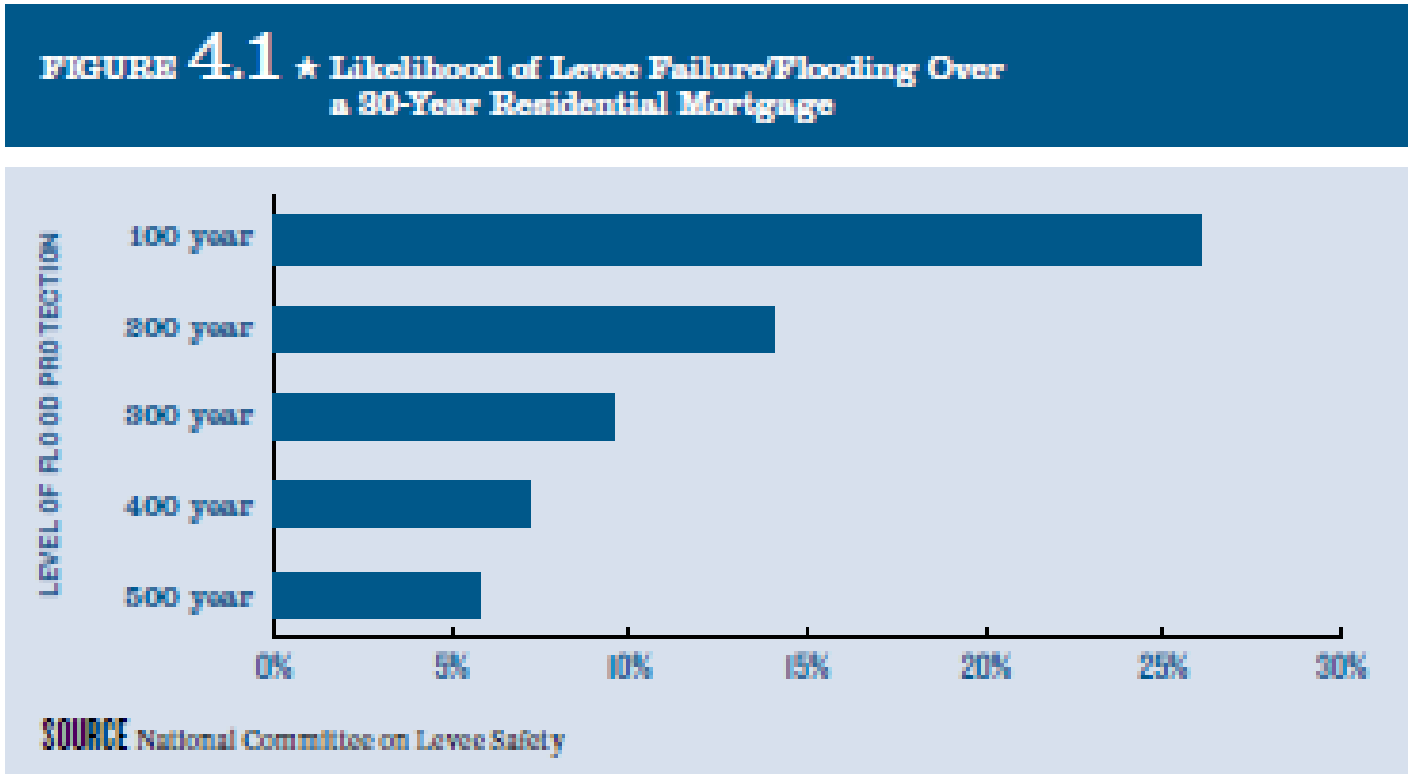
Perspectives on Resilience
Rethinking The New Normal



©ASCE 2018

Why it is so important to get the predictions and investments right …

© Zurich

Perspectives on Resilience
Insurers Actions

ZURICH

What Can Insurers Do to Assist Stakeholders?

- **Insurers must be allowed to use their core skills to send risk based price signals**
  - Higher cost should incentivize risk reduction
  - Government indemnity or pools which spread or mask risk may inadvertently increase moral hazard and overall risk
- **Champion policy that addresses governance gaps**
  - Government should consider regulation / law changes that recognize the costs of mitigation must be passed on to users IF we are to truly incorporate this EXTERNALITY
  - Policy makers must consider new / emergent resource / rights conflicts that present in a non-fossil fuel paradigm
  - Share lessons learned to promote a long-term value proposition
- **Push incentive policies that enables markets to function properly**
  - Incentives should be constructed carefully to avoid moral hazard increase and market instability
  - Consider whether finance subsidies “undo” incorporation of the EXTERNALITY
  - Transition pathway from subsidy to independence must be mapped
- **Recognize the regional nature of risks**
  - One size does not fit all impact risks
  - Greatly impacted by Climate Change
  - Solutions should be regionally tailored but globally aligned / compatible

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Perspectives on Resilience
Sustainability Components

ZURICH

Sustainability is about how ESG and our behaviors drive long-term value, hand-in-hand with our purpose and values

«Sustainability means doing business today in a way that safeguards our future in the face of a transforming society»

Sustainability is critical to business:

- **Ensure a livable future** - When we don't act responsibly we are choosing to exacerbate the problems future generations will face. The choices we make right now have a direct impact on the future.
- **Build resilience** - Every hedge against a potential future problem increases an organization's inherent resilience.
- **Risk mitigation** - example: with energy costs rising and uncertainty in supply, it is important that companies start re-thinking how they obtain and use inputs

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Perspectives on Resilience
Recovery With Speed

Economic Resilience

- Prepare and plan for, absorb, recover from and more successfully adapt to adverse events.
- Economic resilience becomes inclusive of three primary attributes: the ability to recover quickly from a shock, the ability to withstand a shock, and the ability to avoid the shock altogether.

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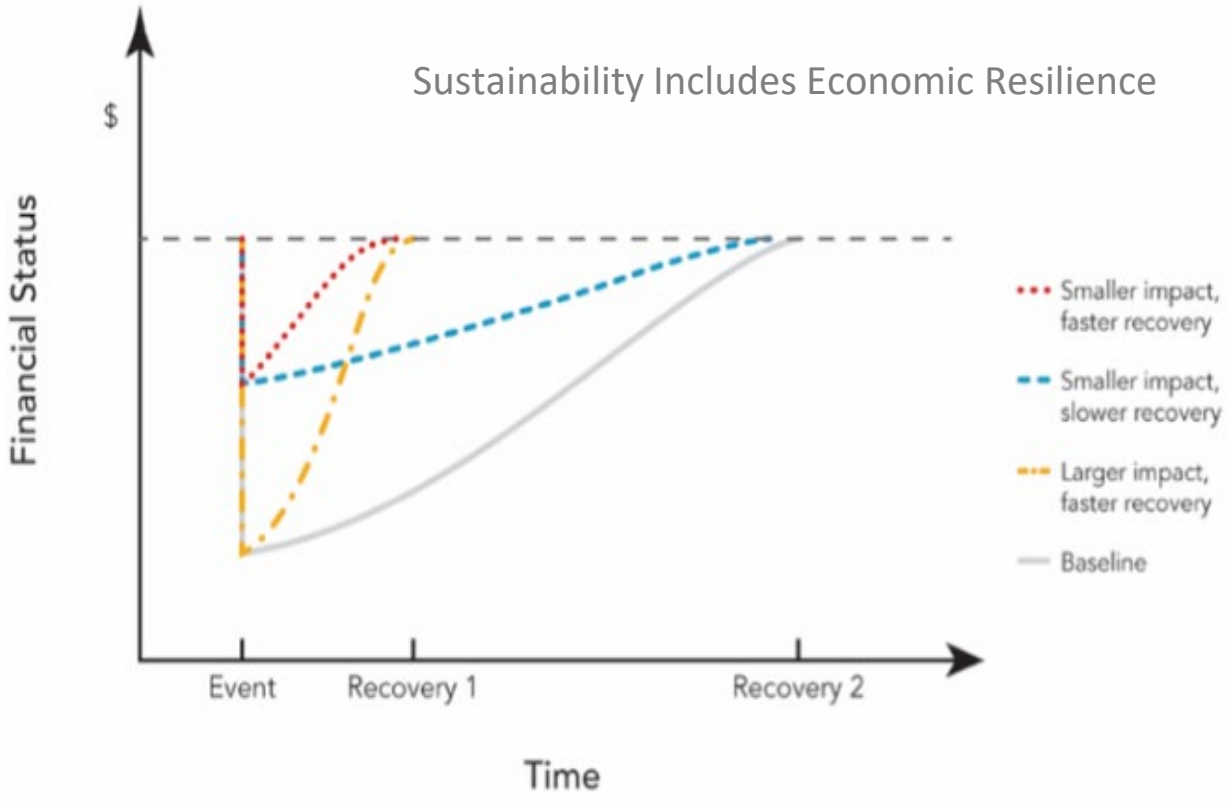
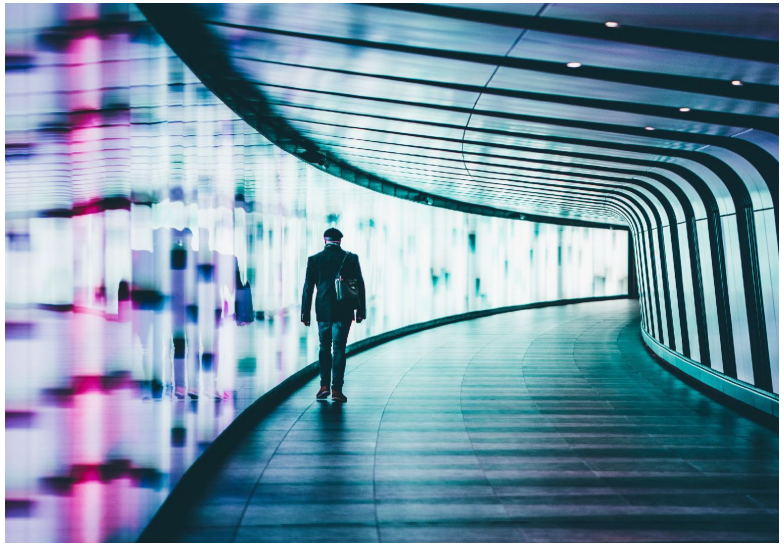
Perspectives on Resilience
Recovery With Speed

Simply Better Business



Economic resilience becomes inclusive of three primary attributes: the ability to recover quickly from a shock, the ability to withstand a shock, and the ability to avoid the shock altogether.



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Paul Mathew

Lawrence Berkeley National Laboratory

Energy Risk in Commercial Mortgages

Paul Mathew Lawrence Berkeley National Lab
Paulo Issler University of California, Berkeley
Nancy Wallace University of California, Berkeley

Better Buildings Webinar

February 2021

The link between energy risk and mortgage valuation

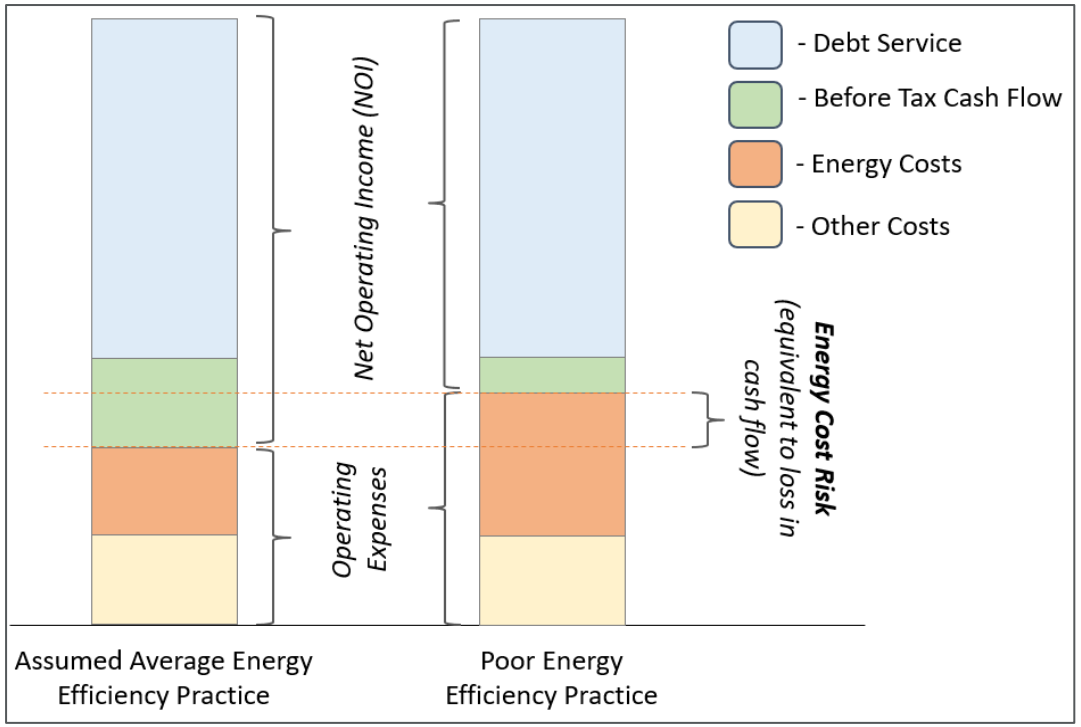
Energy directly affects Net Operating Income (NOI) used in valuation.

Current practice does not fully account for these factors in NOI

- Usually based on historical average cost data, if available
- Does not account for energy use and price volatility *during* mortgage term

Energy risks in mortgages are exacerbated with climate change and can be mitigated with energy resilience.

Key question: How much do energy risks "move the needle" for NOI and default risk?



Energy Risk Factors:

Energy use and volatility

Energy price and volatility

DOE effort: Empirical research and industry engagement

Vision: Energy factors fully and routinely incorporated in the commercial mortgage process, accelerating demand for buildings with lower energy risk and higher resilience.

Opportunity: Commercial mortgages are potentially a major channel for efficiency and resilience investments.

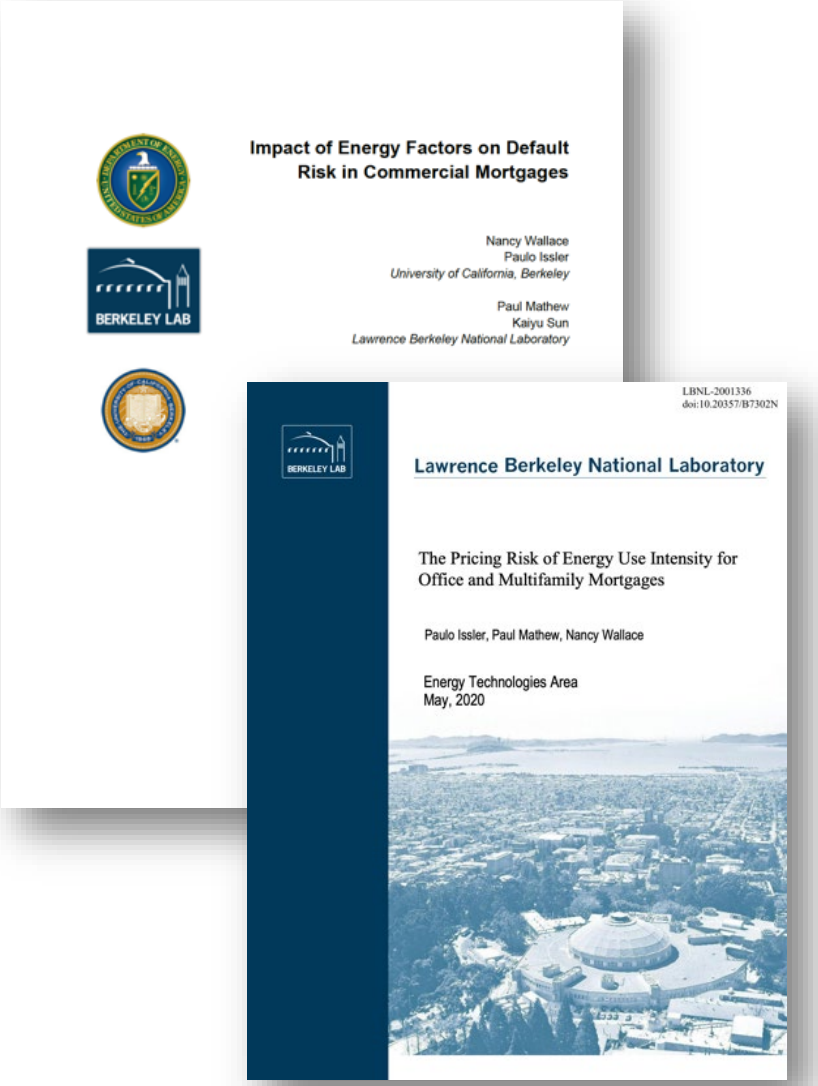
Two thrusts:

- **Build the evidence**: analyze impacts of energy risk on mortgage valuation
- **Engage lenders**: conduct pilot analysis, develop methods to incorporate energy risks in valuation

Building the evidence

- Empirical analyses linking default risk to source EUI and electricity price for office and multifamily

- Pricing analysis: Impact of energy risk on coupon rate and origination points



Reports available at:
https://buildings.lbl.gov/cbs/energy-factors-commercial-mortgages

The link between energy and mortgage default

Three empirical analyses

1. TREPP data + energy benchmarking data (office, mixed use, multifamily)
2. TREPP data + energy monitoring data (multifamily)
3. Fannie Mae data (multifamily)

All three showed energy use and electricity price have a statistically significant impact on default

- Higher ***Source EUI*** => higher likelihood of default.
- Higher ***Scaled Source EUI*** (source EUI/NOIpsf) => higher likelihood of default
- Higher ***Electricity Price Gap*** => higher likelihood of default
  (gap = difference between actual and expected electricity prices since loan origination)

Mortgage Pricing Analysis: Points and Coupon Sensitivity to Source EUI Shocks

Mortgage and coupon sensitivities to shocks on scaled source EUI (Δ1.0%)

	Points sensitivity to 1% change in Scaled Source EUI	Coupon sensitivity to 1% change in Scaled Source EUI
Office Loans	7.71 bp	2.10 bp
Multifamily Loans	4.00 bp	0.84 bp

In principle, an office building with 10% lower source EUI should get ~21bp discount on its mortgage interest rate

Engaging Lenders: Pilot Studies

- Pilot studies on specific loans
- Development and testing of energy risk metrics for underwriting

LBNL-2001112

Lawrence Berkeley National Laboratory

Impact of Energy Use and Price Variations on Default Risk in Commercial Mortgages: Case Studies

Paul Mathew, Kaiyu Sun, Baptiste Ravache, Paulo Issler & Nancy Wallace

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Should commercial mortgage lenders care about energy efficiency? Lessons from a pilot study

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ABSTRACT

Commercial mortgage underwriting practices currently do not fully account for energy risks to net operating income (NOI), especially changes in energy costs over the course of a mortgage term. This paper first introduces two metrics that can be used to characterize the increase in default risk due to increases in energy costs during a mortgage term: decrease in debt service coverage ratio (ΔDSCR); and increase in probability of default (ΔDP). Both these metrics were designed to be simple to calculate, utilizing data that are already being collected in loan applications. Next, we present results from a pilot study on the application of these metrics to five loans from three lenders. The results show that energy risks can vary between different properties and across different years within a given property, due to variations in energy usage. All three lenders concurred that these results suggest energy risks can in fact be material, and affirmed the metrics are a viable approach to incorporate energy risk analysis into mortgage underwriting. The policy implications include energy cost disclosure in loan applications; and incentives such as lower interest rates for energy efficient buildings and additional loan proceeds to improve efficiency and lower energy costs.

1. Introduction

Commercial mortgages are generally underwritten based on the net operating income (NOI) of a building, i.e., the gross revenue from rents less expenses for utilities, maintenance, insurance, etc. Energy costs paid by the building owner directly affect the NOI of the building. All other things being equal, a building with lower energy costs has higher net operating income, and therefore lower probability of default. However, commercial mortgage underwriting practices currently do not fully account for energy risks on NOI. For instance, representative averages of energy costs are often assumed, instead of applying the actual figures (which are sometimes difficult to obtain by parties to a mortgage). Furthermore, volatility in energy use and price are not considered. As a consequence, energy efficiency is not properly valued and energy risks are not properly assessed and mitigated (Jaffee et al., 2013; Mathew et al., 2016).

In this paper we present results from a pilot study on the application of energy risk metrics in commercial mortgage underwriting and the policy implications thereof. We developed two marginal risk metrics - increase in default risk and decrease in debt service coverage ratio - and apply them to five loans from three different lenders. The purpose of the study is to provide insights on the viability of using such metrics routinely for incorporating energy risk into commercial mortgage underwriting.

First, we provide background on previous empirical studies demonstrating the links between energy costs and commercial mortgage default risk. Next, we present the two energy risk metrics that were developed specifically for application in commercial mortgage underwriting. We then present the approach to, and results from, the application of these metrics to five loans from three lenders, including response from the lenders. We conclude with policy implications for routine adoption of energy risk analysis in commercial mortgage underwriting.

2. Background

2.1. The link between energy and mortgage default risk

There have been a number of studies looking at the relationship between energy efficiency or 'green' features and the financial value of buildings (see, for example, Dermisi 2009; Eichholtz et al., 2013; Devine and Kok 2015; Fuerst and McAllister 2011; McGrath 2013; Reichardt

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Reports available at:
https://buildings.lbl.gov/cbs/energy-factors-commercial-mortgages

ΔDSCR: Change in DSCR due to change in energy costs

- Quantifies reduction in DSCR due to energy cost tail risk
- Easily calculated from debt service, energy costs, lookup tables.

$$\Delta DSCR = \frac{\Delta NOI}{DS} = \frac{\Delta EC}{DS}$$

Δ NOI: change in net operating income due to change in energy costs
DS: debt service
Δ EC: change in energy costs (see next slide)

Example:

NOI	$130,000
DS	$100,000
DSCR	**1.3** ($130,000/$100,000)
ΔEC	$7,000
ΔDSCR	**-0.07** ($7,000/$100,000)

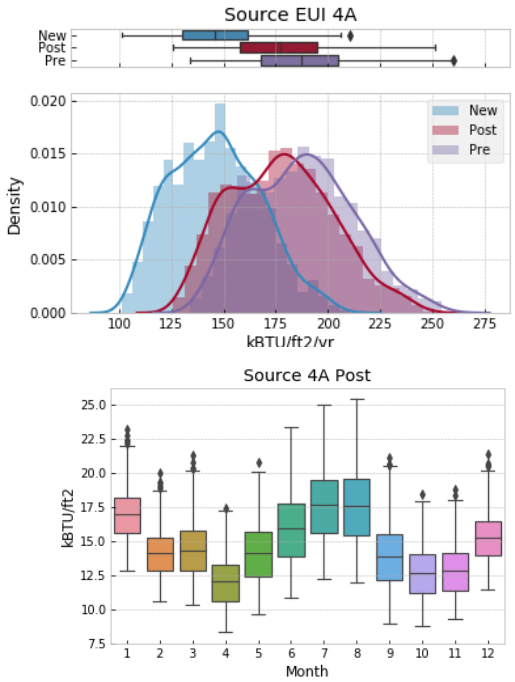
If tail risk materialized,
DSCR = 1.3 - 0.07 = ***1.23***

Calculation of change in energy costs ΔEC

Δ EC is the potential increase in energy costs due to unexpected changes in occupancy, building systems, weather.

$$\Delta EC = EC \times ERF$$

Δ EC: change in energy costs
EC: energy costs used for underwriting
ERF: energy risk factor



ERF look-up table

Use type	Location	Vintage	Area (ksf)	ERF
Office	New York	Pre-1980	<50	0.30
			50–150	0.28
			>150	0.26
		1980-2000	…	
		Post-2000	…	
	Houston	…		
Retail	…			
…				

illustrative

ERF values generated from 100s of parametric energy simulations.
ERF = 2xSD/Mean

Exploratory analysis of 5 loans from 3 lenders

- Loan data from annual NOI statements
- Energy risk: energy cost increase by two standard deviations

ID	Building type	Size (sq.ft)	Location	Year built	Years of data	DSCR range	**Energy Risk ΔDSCR**	
OF1	Office	16,362	Washington, DC	1968	2012-2018	1.52-2.00	**0.04-0.05**	*Very low risk*
OF2	Office	31,175	Denver	1906	2016-2017	0.73-0.78	**0.02-0.03**	*Low energy risk but DSCR < 1*
MF1	Multi-family	207,078	New York City	1926	2016-2017	2.62-3.20	**0.19-0.30**	*High energy risk mitigated by very high DSCR*
MF2	Multi-family	45,495	New York City	1915	2016-2017	1.30-1.45	**0.07-0.09**	*Energy risk could make DSCR < 1.25*
MF3	Multi-family	622,980	Arlington, VA	1998	2013-2018	1.98-2.17	**0.01**	*Very low risk*

Application of Δ DSCR in loan portfolios

Pre-screen

- If DSCR is high (e.g. >1.5), no need for energy risk analysis

Calculate ΔDSCR

- Data:
  - debt service
  - energy cost
  - use type
  - location
  - vintage
- ERF look-up tables

Evaluate ΔDSCR

- Compare to DSCR for this loan.
- Compare to ΔDSCR for other loans

Act

- Low risk: consider rate discounts
- High risk: consider rate premium or require mitigating measures

Coupon discount for efficient buildings

- Coupon discount look up tables based on DSCR and energy efficiency
  - Analogous to loan level pricing adjustments (LLPA) tables
  - Values derived from mortgage pricing simulations

Example: Fannie Mae LLPA tables

Table 1: All Eligible Mortgages – LLPA by Credit Score/LTV Ratio

Representative Credit Score	LTV Range									
	Applicable for all mortgages with terms greater than 15 years									
	≤ 60.00%	60.01 – 70.00%	70.01 – 75.00%	75.01 – 80.00%	80.01 – 85.00%	85.01 – 90.00%	90.01 – 95.00%	95.01 – 97.00%	>97.00%	SFC
≥ 740	0.000%	0.250%	0.250%	0.500%	0.250%	0.250%	0.250%	0.750%	0.750%	N/A
720 – 739	0.000%	0.250%	0.500%	0.750%	0.500%	0.500%	0.500%	1.000%	1.000%	N/A
700 – 719	0.000%	0.500%	1.000%	1.250%	1.000%	1.000%	1.000%	1.500%	1.500%	N/A
680 – 699	0.000%	0.500%	1.250%	1.750%	1.500%	1.250%	1.250%	1.500%	1.500%	N/A
660 – 679	0.000%	1.000%	2.250%	2.750%	2.750%	2.250%	2.250%	2.250%	2.250%	N/A
640 – 659	0.500%	1.250%	2.750%	3.000%	3.250%	2.750%	2.750%	2.750%	2.750%	N/A
620 – 639	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.500%	3.500%	N/A
< 620[1]	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.750%	3.750%	N/A

Coupon Discount look-up tables

- Values derived from mortgage pricing simulations
- Efficiency metric: Scaled Utility Cost Intensity (ScUCI)

$$\text{ScUCI} = \frac{UC}{NOI}$$

UC: utility cost
NOI: net operating income

Scaled Utility Cost Intensity	DSCR range			
	<1.0	1.0 - 1.25	1.25 - 1.5	>1.5
> 0.4				
0.3-0.4				
0.2-0.3				
0.1-0.2				
<0.1				

illustrative

The next pilot study

- Risk analysis on a portfolio of office and/or multi-family to test usefulness of metrics and ease of application
- DOE team will conduct analysis
- Participants will provide data and review results

Data needed:

- Loan origination (NOI, debt service)
- Utility costs
- *Optional:* loan performance data, PCA data

What stakeholders can do now

Lenders:

- Ask owners to provide data on energy cost range.
  - Could be done as part of Property Condition Assessment (PCA).
  - Can use ASTM standards
- Incorporate energy risk into underwriting and terms
  - e.g. Interest rate discount for lower risk
- Offer additional loan proceeds for energy and resilience investments
  - E.g. Fannie Mae program

Owners:

- Ask lenders to account for energy efficiency when setting mortgage terms.
- Provide data on energy costs and efficiency to lender.
  - In appraisal and/or PCA

Thank you

Paul Mathew

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Q & A

Submit Questions
www.slido.com event code **#DOE**

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Additional Resources

- Better Buildings Financing Navigator
- Better Buildings Finance Resilience Toolkit

- More information about Four Twenty Seven
- A recent webinar – Climate Change, Real Estate and the Bottom Line – in which Emilie Mazzacurati, Global Head of Moody's Climate Solutions and Founder and CEO of Four Twenty Seven, engages in a discussion on the interactions between climate change and real estate investment, development and operations.
- Recommendations of the Task Force on Climate-related Financial Disclosures
- Moody's Investors Service 2021 Global ESG Outlook
  - *Note that while access to the report is free, accessing it will require registration.*

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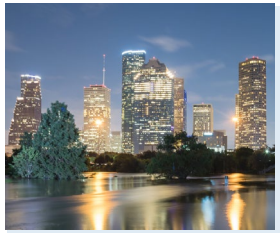

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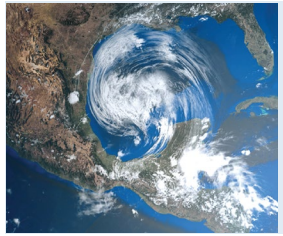

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