Insurance Perspective: Energy Resilience

Energy Master Planning for Resilient Communities
National Academy of Sciences
Washington, DC

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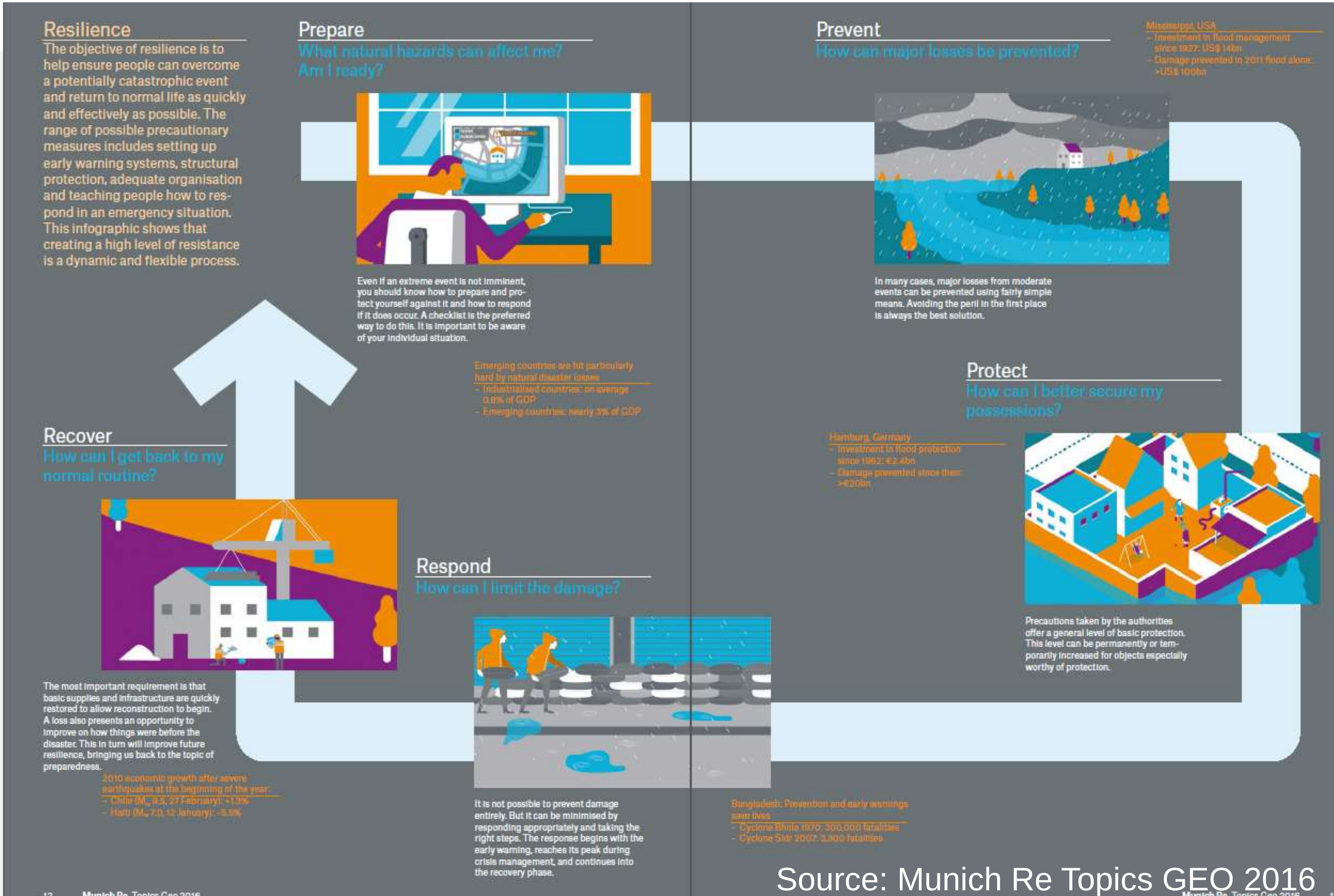
Wednesday, December 6, 2017
David R. Tine

Risk Solutions

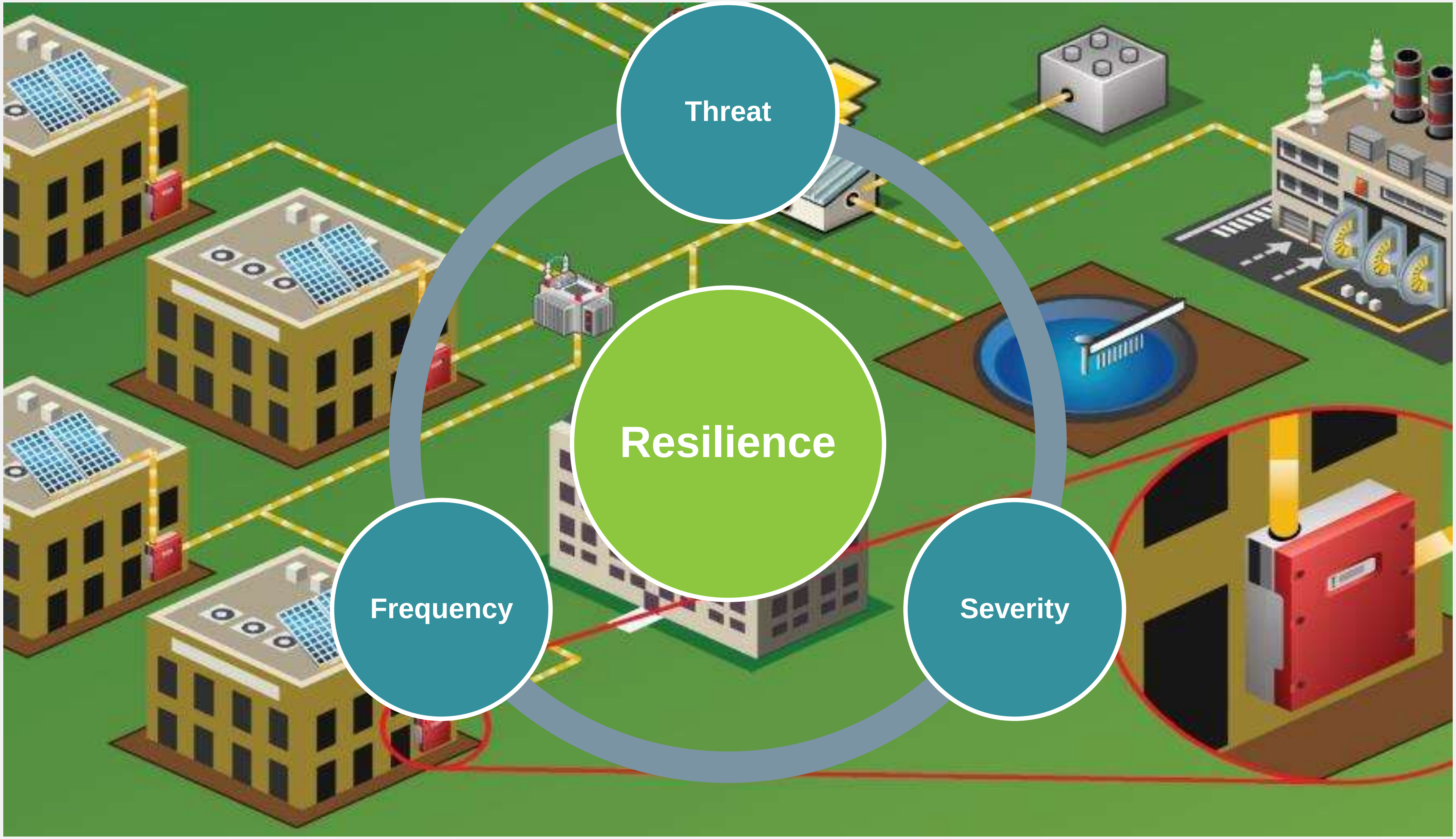
Munich RE ®

Returning to Routine



Source: Munich Re Topics GEO 2016

Frequency/Severity/ Threat



Insurance Perspective

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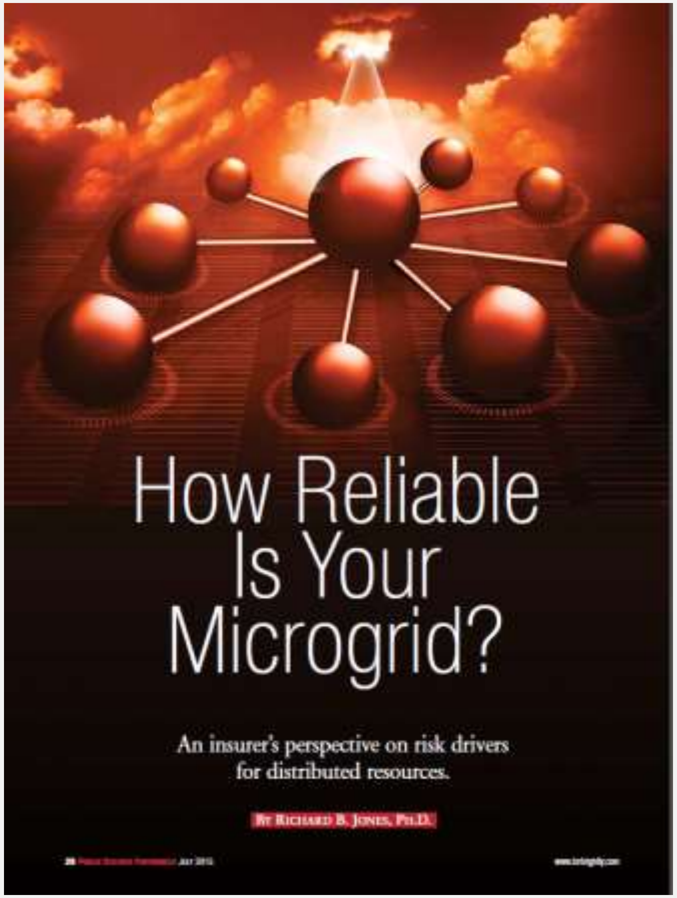
- Insurance companies are central to the revitalization efforts of communities and businesses as they respond to the effects of natural disasters.
- Two models utilized from the perspective of risk mitigation and insurance:
  - Blackout Risk Modeling
  - Microgrid Reliability Model



"How Reliable is Your Microgrid" by Richard Jones, Public Utilities Fortnightly, July 2015

Blackout Risk Model™

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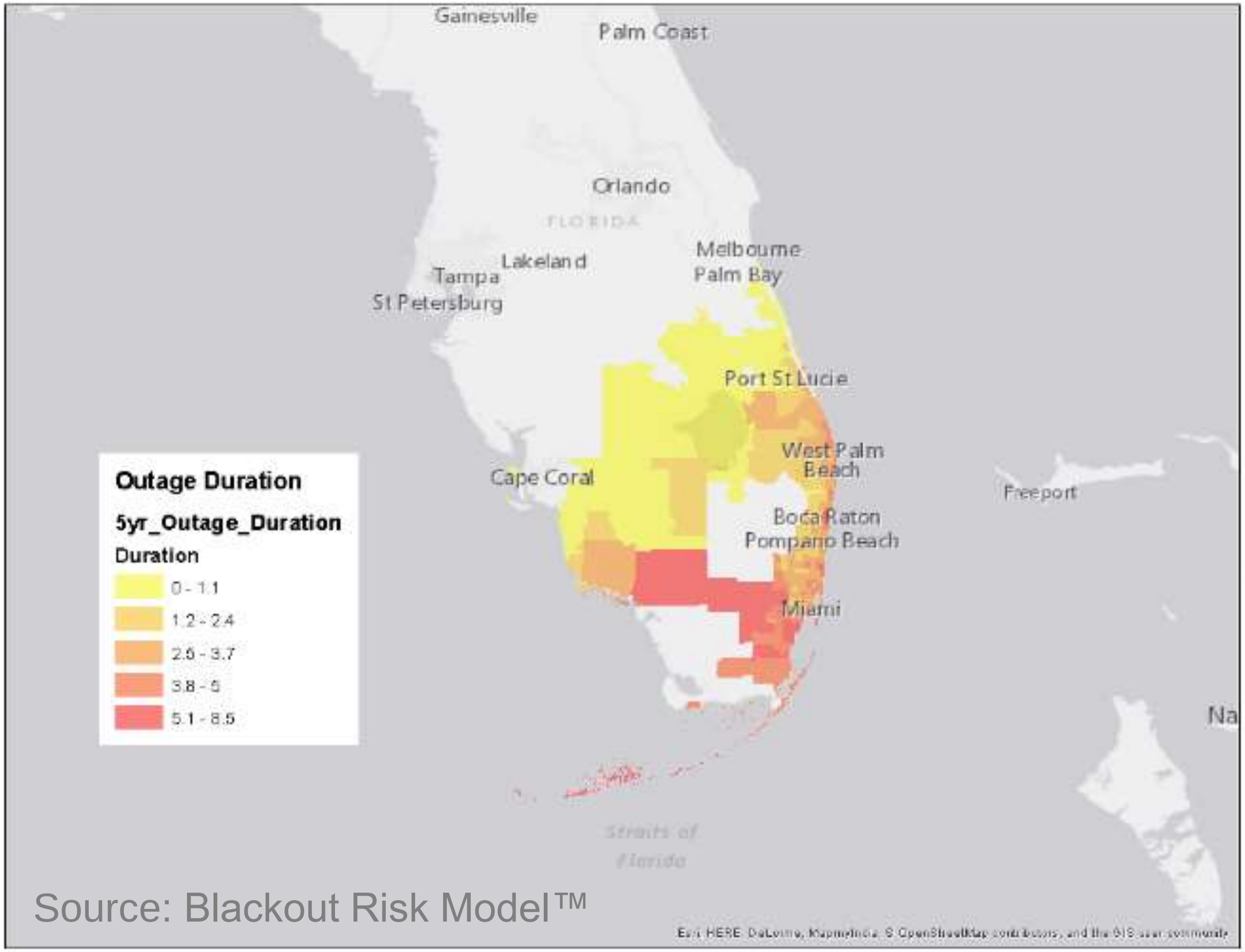
Verisk Climate™

Focuses on the U.S. power grid and incorporates extensive data on four peril categories: Hurricanes, winter storms, thunderstorms, and equipment failure or operator error. Wild fires and terrorism attack loss scenarios can also be tested. This includes:

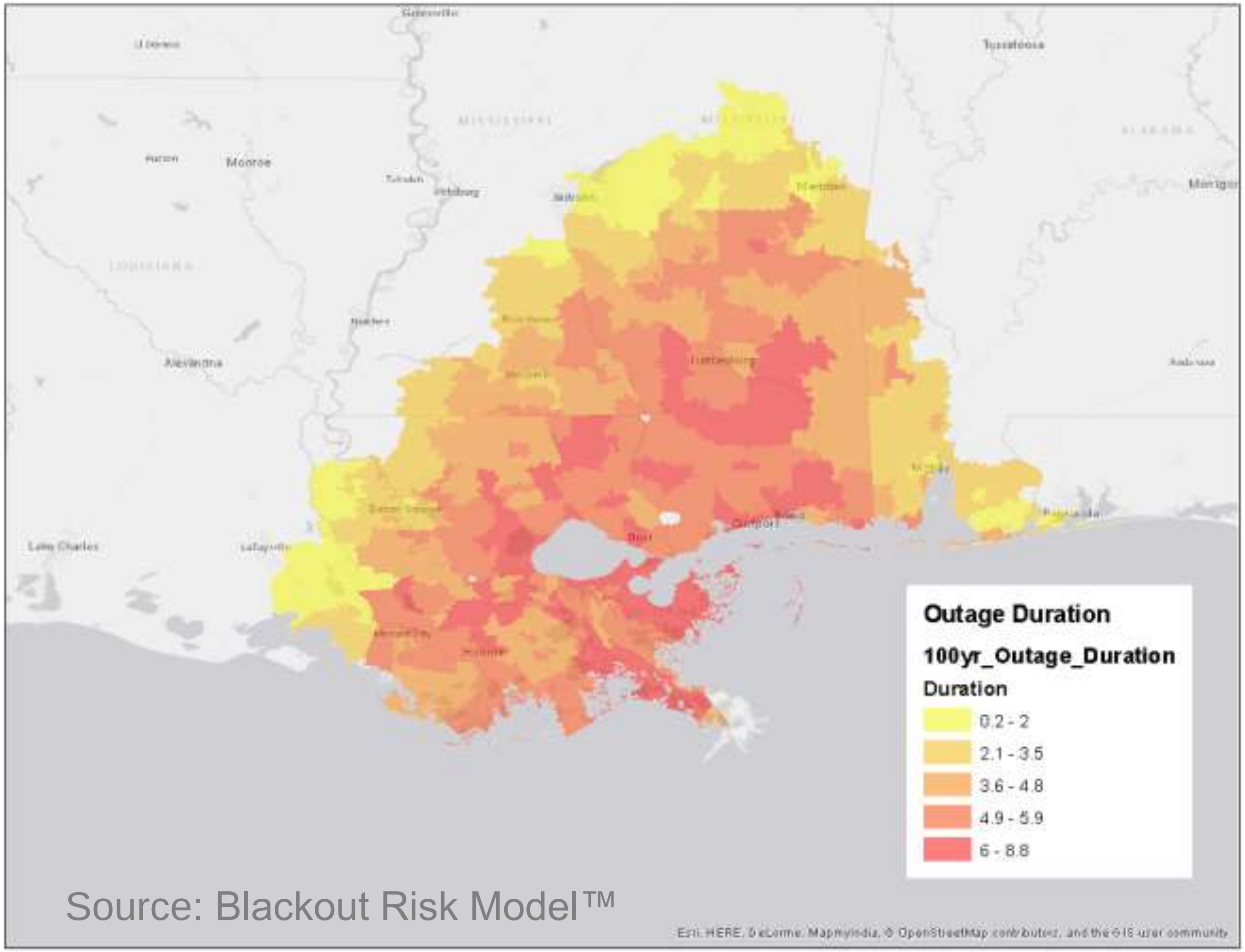
- **Severe weather events**
- **Electrical grid**
- **Tree proximity to power lines**

Blackout Risk Model™ Hurricane Outage Duration, 5yr return per., 2.47 days average

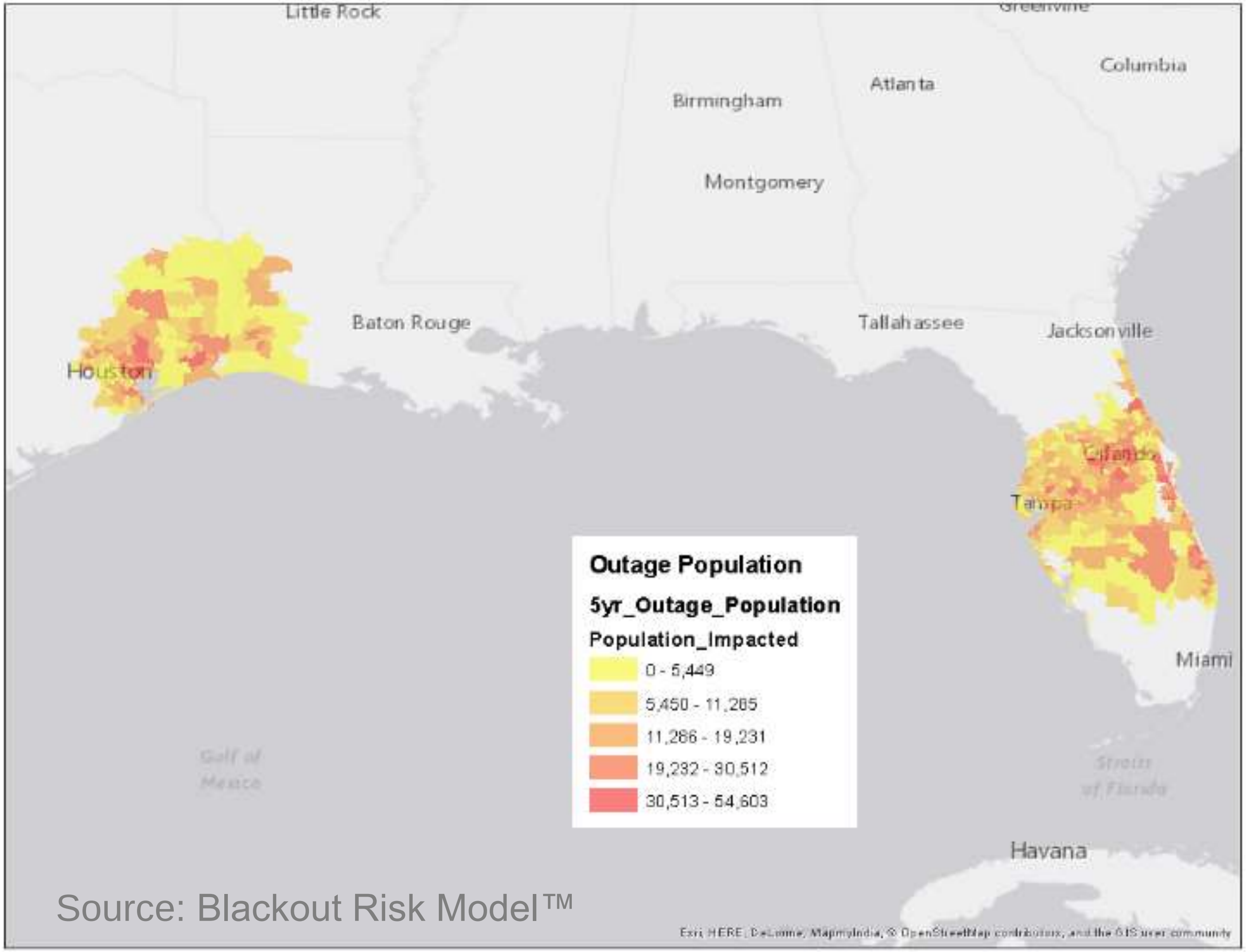


Source: Blackout Risk Model™

Blackout Risk Model™ Hurricane Outage Duration, 100yr return per., 3.96 days average



Blackout Risk Model™ Hurricane Outage Population, 5yr return per., 7,716,839 people impacted



Source: Blackout Risk Model™

Blackout Risk Model™ Hurricane Outage Population, 100yr return per., 25,095,957 people impacted

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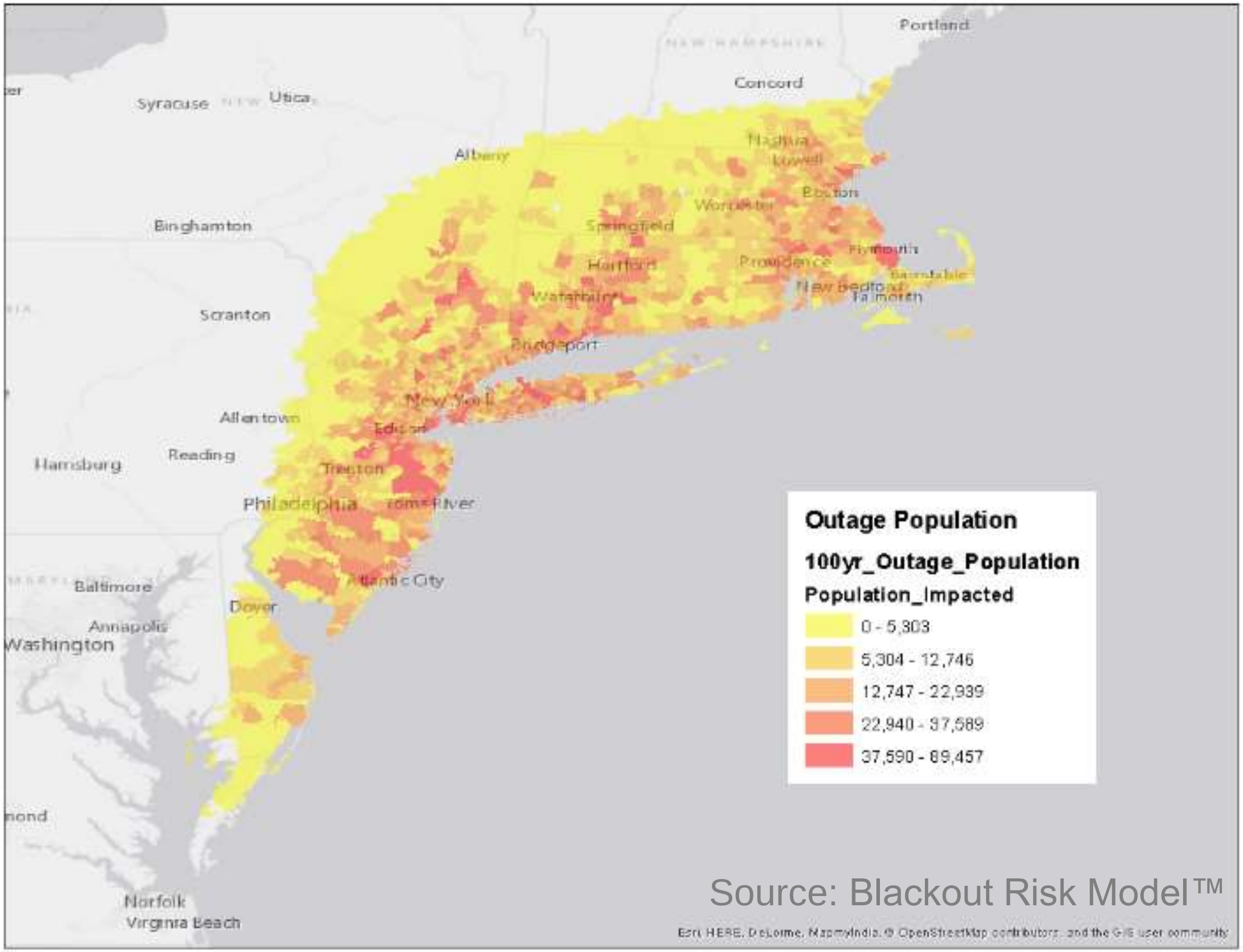
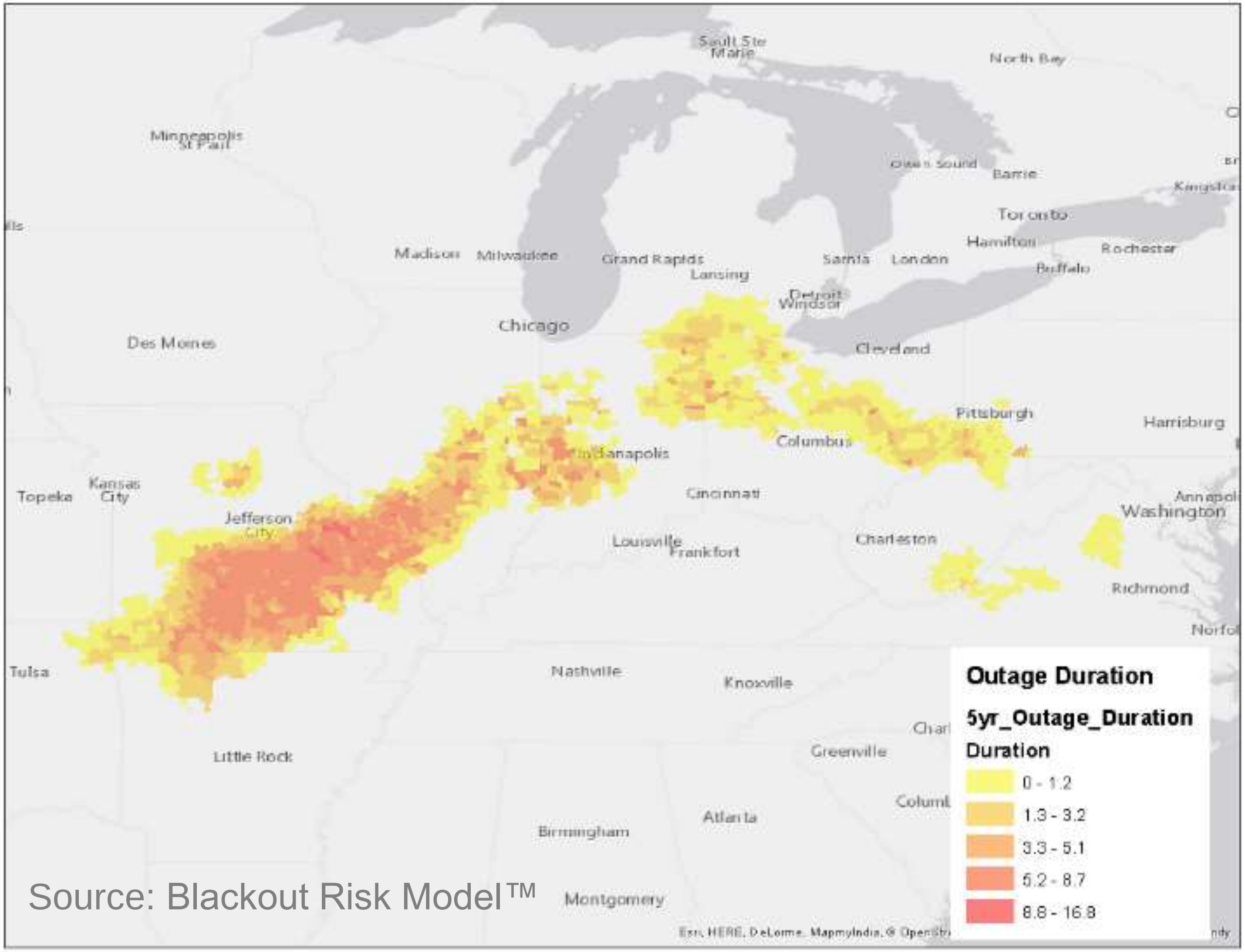


Blackout Risk Model™ Winterstorm Outage Duration, 5yr return per., 1.92 days average



Source: Blackout Risk Model™

Blackout Risk Model™ Winterstorm Outage Duration, 100yr return per., 6.45 days average

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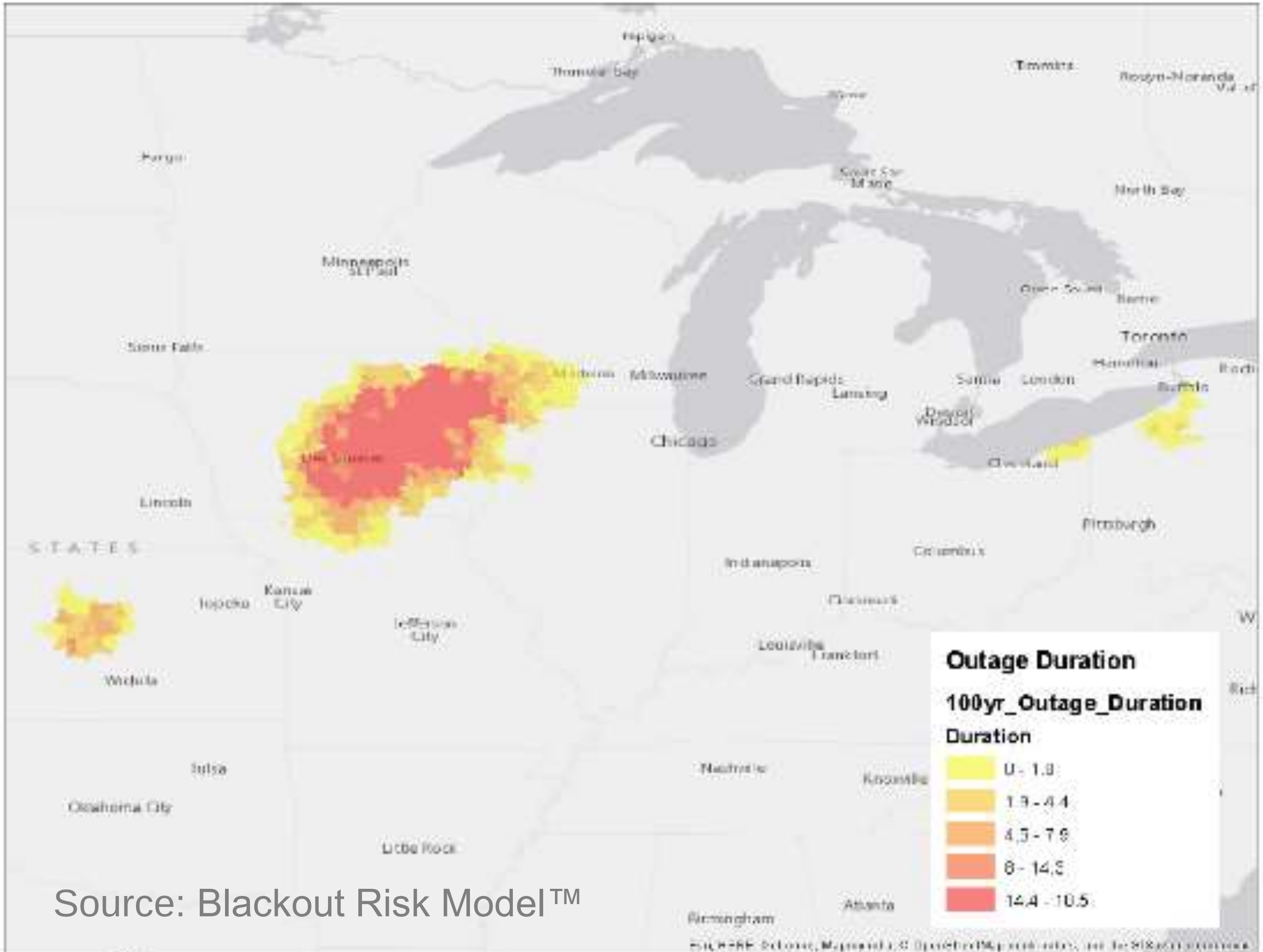
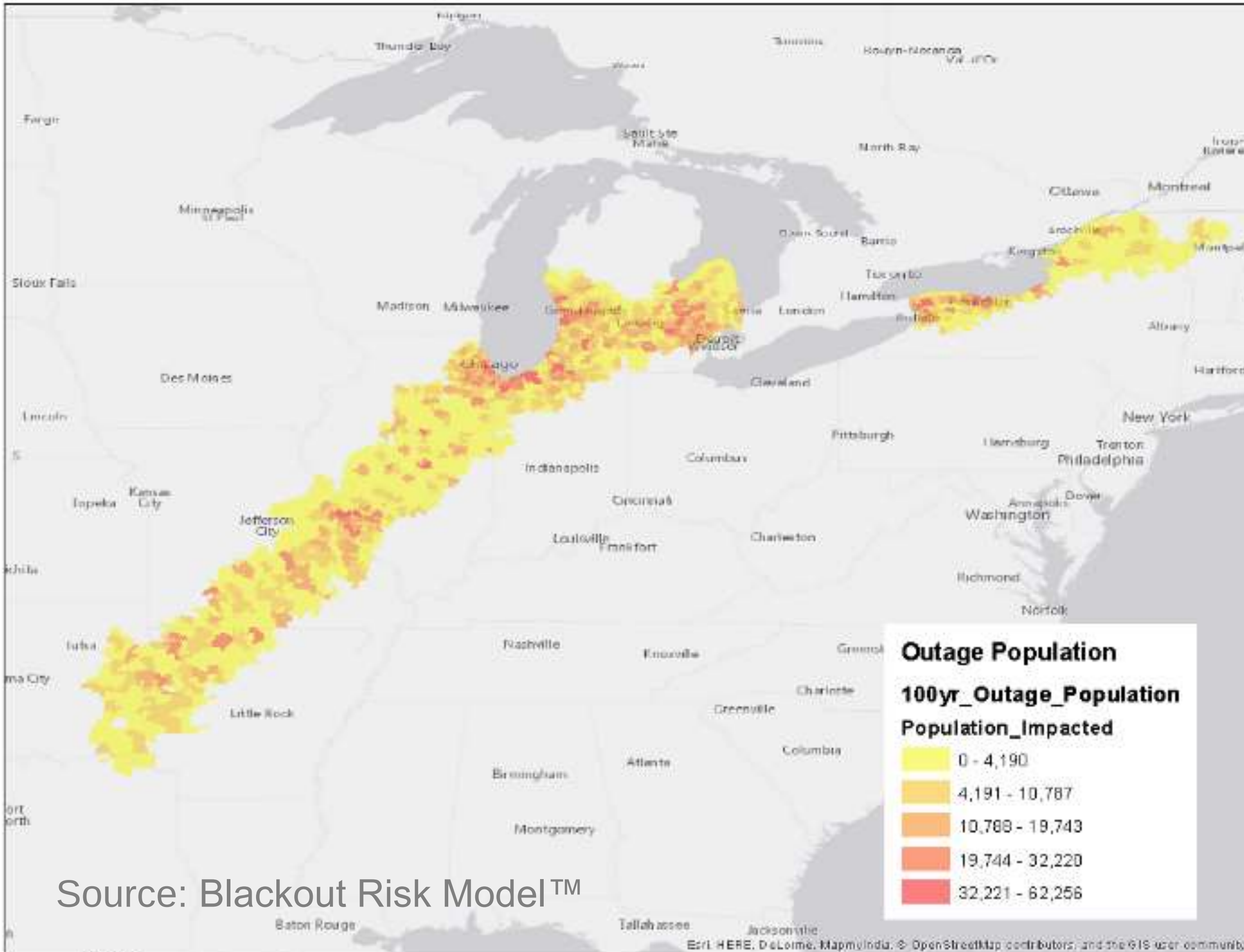


Source: Blackout Risk Model™

Blackout Risk Model™ Winterstorm Outage Population, 100yr return per., 15,206,691 people impacted

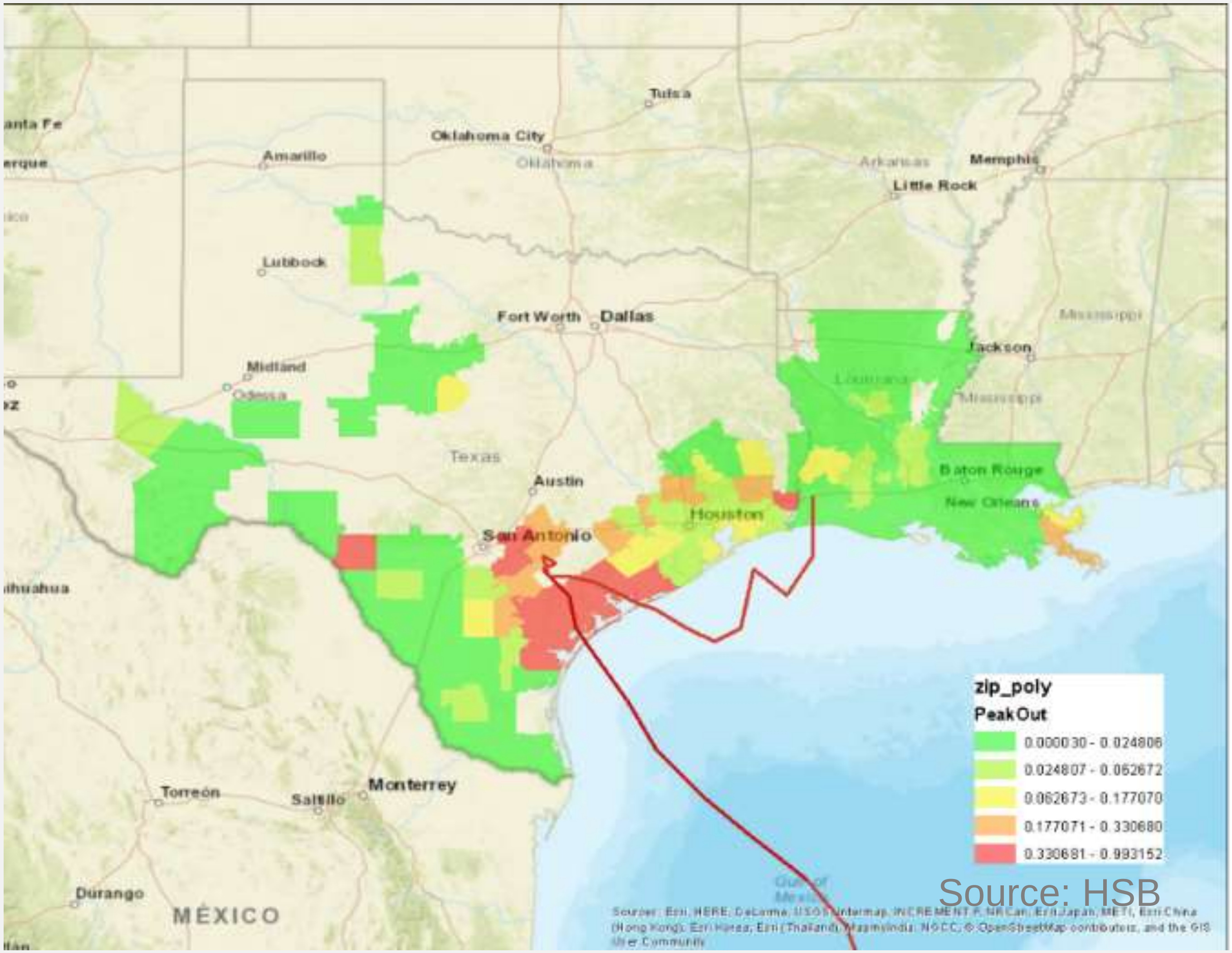


Notional Loss Analysis

- Assume $10 Mil of annual BI exposure in all US zip codes
  - This could represent 1 $10 Mil exposure or several smaller exposures totaling $10 Mil.
- 24 hr. waiting period / deductible
- Return period is probability of occurrence
  - i.e. 5 yr is 20% chance in one year
  - i.e. 100 yr is 1% chance in one year

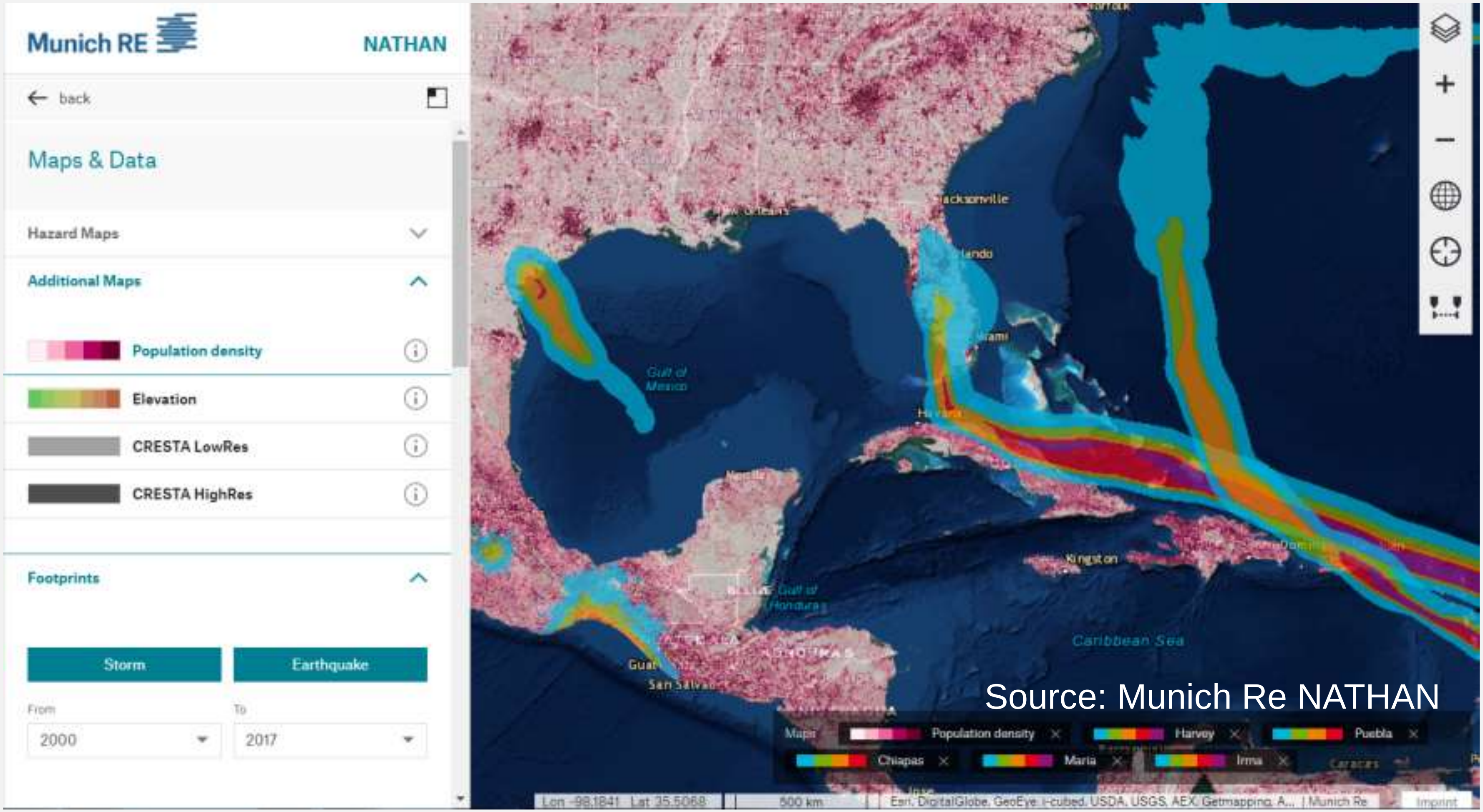
Return Period	Hurricane	Winterstorm
1000	$318,000,365	$597,849,489
500	$284,026,307	$521,753,166
250	$247,325,162	$418,962,302
100	$192,864,230	$276,838,550
50	$149,479,089	$199,762,238
25	$107,578,614	$152,285,187
5	$40,806,485	$57,925,226
Average	$32,514,423	$48,460,274

Hurricane Harvey Power Outages
Peril Considerations – Flood vs Wind



Source: HSB

Munich RE applications NATHAN & natcatService



NatCatSERVICE

Loss events in North America 1980 – 2016

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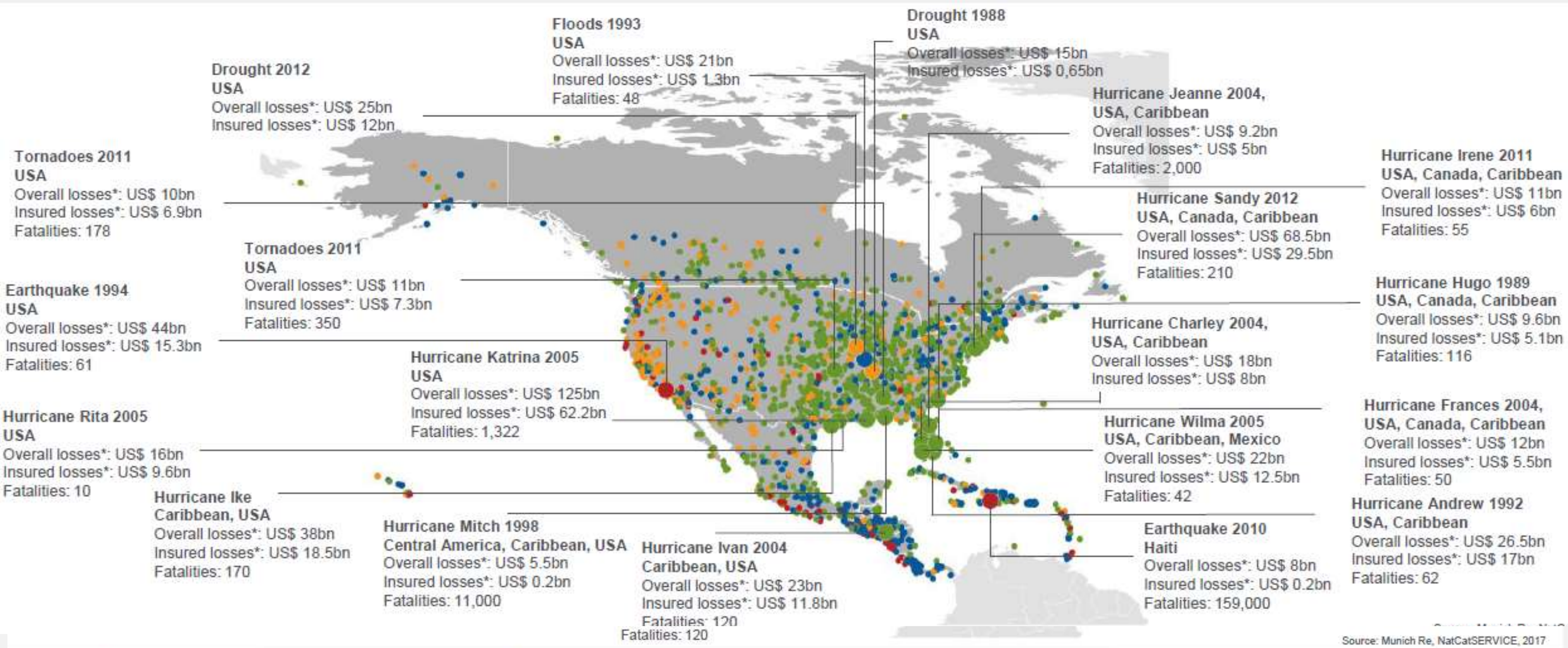
Geographical overview (including Caribbean and Central America)



- **Geophysical events** (Earthquake, tsunami, volcanic activity)
- **Meteorological events** (Tropical storm, extratropical storm, convective storm, local storm)
- **Hydrological events** (Flood, mass movement)
- **Climatological events** (Extreme temperature, drought, wildfire)

○ **Loss events** ◯ **Selection of catastrophes**

Source: Munich Re NatCatSERVICE

*Losses in original values

Valuing Resilience: Risk Considerations

1. Risk Modifiers for loss prevention activities

   a) A robust, fast response repair program has a major risk reduction effect for both availability and lost production risk.

   b) Energy storage has a risk reduction benefit.

2. Weather influences need to be considered during design and construction specifications.

3. A Performance Risk Analysis Model can help direct resources to the major risk drivers.

4. Standard property insurance is prudent but system performance insurance may help in funding if performance can be related to revenue.

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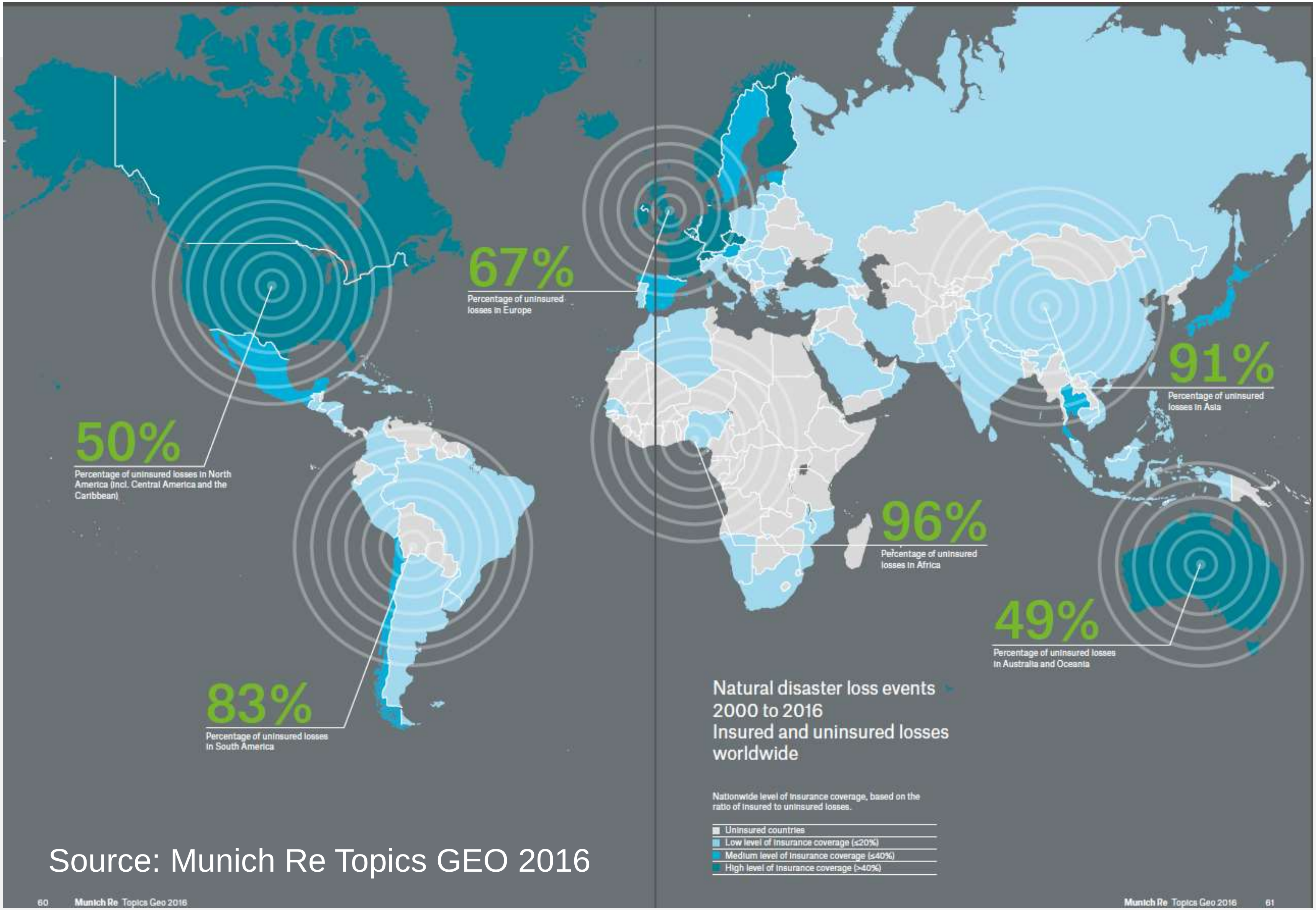
Appendix- MunichRe Topics GEO



Appendix - Standard Insurance Coverage:Loss Valuation

Equipment Breakdown

Business Income

Extra Expense

Spoilage Damage

Utility Interruption

Appendix: typical risk model results
NY Prize Microgrid: illustration only

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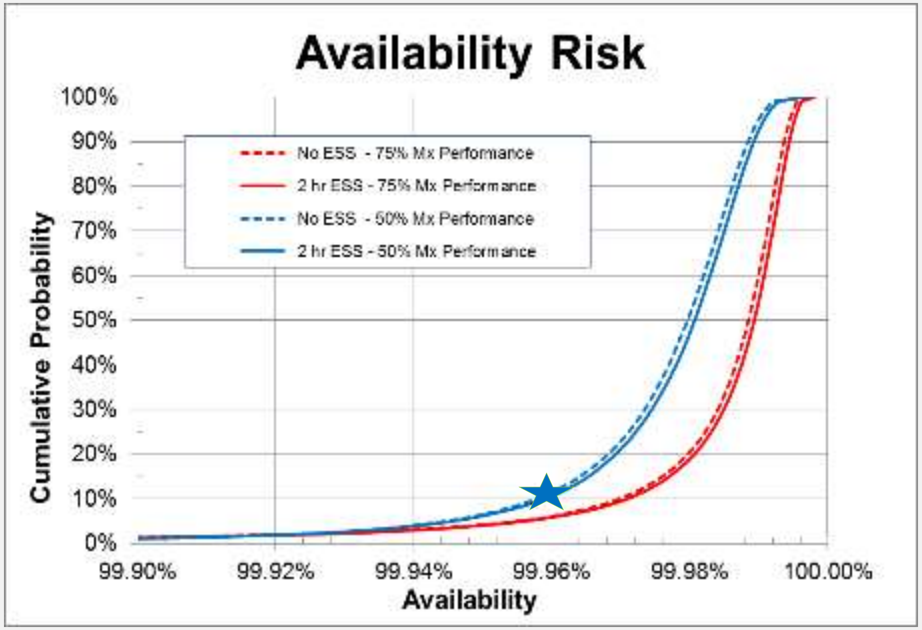
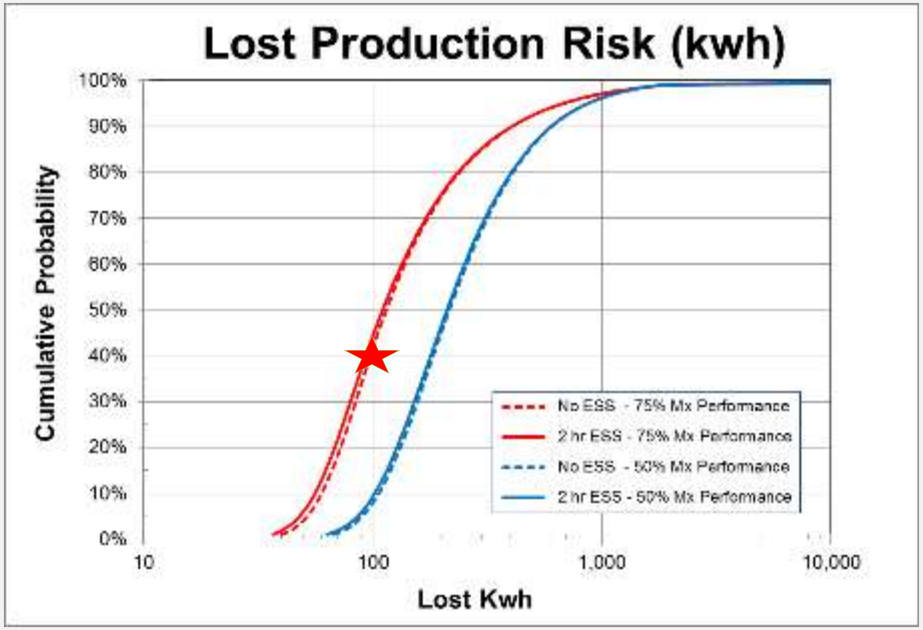
Energy Storage (ESS) Duration of 2 Hours – For this situation (modeled in this case only) ESS has significantly less value risk reduction value than the Component Repair Strategy





★ There is ~ 10% chance that the annual availability will be < 99.96%.

★ There is ~ 40% chance that the annual Lost Kwh will be < 100.