

Parametric Insurance Proposition

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World Bank's pandemic cat bond is a parametric that is not doing so well for investors...

"The highest risk layer of notes is now marked down significantly, with some secondary marks on pricing sheets we've seen seeking bids as low as 5 cents on the dollar for the notes, a roughly 95% mark down and a significant drop from the 45 to 55 cents average bid of last week."¹



...but is functioning exactly like it should for countries that will need the financial support and funding the parametric provides



(1) [Artemis: Pandemic cat bond price plummets on growing coronavirus threat](#)

Agenda

1 Overview: What are parametric insurance products

2 Why are some companies purchasing them

3 Basis risk & product design risk

4 Examples of products

5 Modelling: case studies

6 S.W.O.T. analysis

Parametric insurance uses pre-defined triggers¹ as opposed to damage sustained by an insured

Context

- Parametrics (or index-based) solutions **cover the probability of a predefined event happening rather than indemnifying an actual loss incurred**
 - Event is correlated to loss
- **Payment made upon the occurrence of a triggering event**, and as such is detached of an underlying physical asset or piece of infrastructure
- **Well suited for mitigating earnings and cash flow volatility**
- Make sense when traditional insurance is not available, affordable, or as a complement to traditional insurance
- **Critical is an understanding of the conditions to be used** as a trigger and how they relate to a potential financial or economic loss to the customer

Structure

Trigger

The insurance pay out is depending on a pre-agreed trigger that can be easily measured, actual loss is not used for the pay out

Reporting Agent

The event intensity is measured by a reporting agent (eg. USGS for EQ) who determines the intensity of the event and hence the impact on the claim

Insured

Purchases a pay out cover and pays a premium depending on the cover limit and hazard

Pay out

Premium

Insurer

Takes the risk for a premium and pays out the cover amount for a triggering event

(1) Measured by an objective, transparent, and consistent parameter or index that is related to an insured's particular exposure

Parametric insurance products need an objective trigger

Categories of triggers

Catastrophes



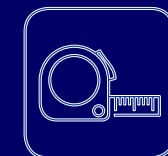
Weather related (and downwind impact)



"Exotics"



The common denominator is **verifiable and objective trigger** that both the insurer and insured agree to measure an event



As an example, a Cat in a box example is a simplified illustration of a parametric product

Description of product

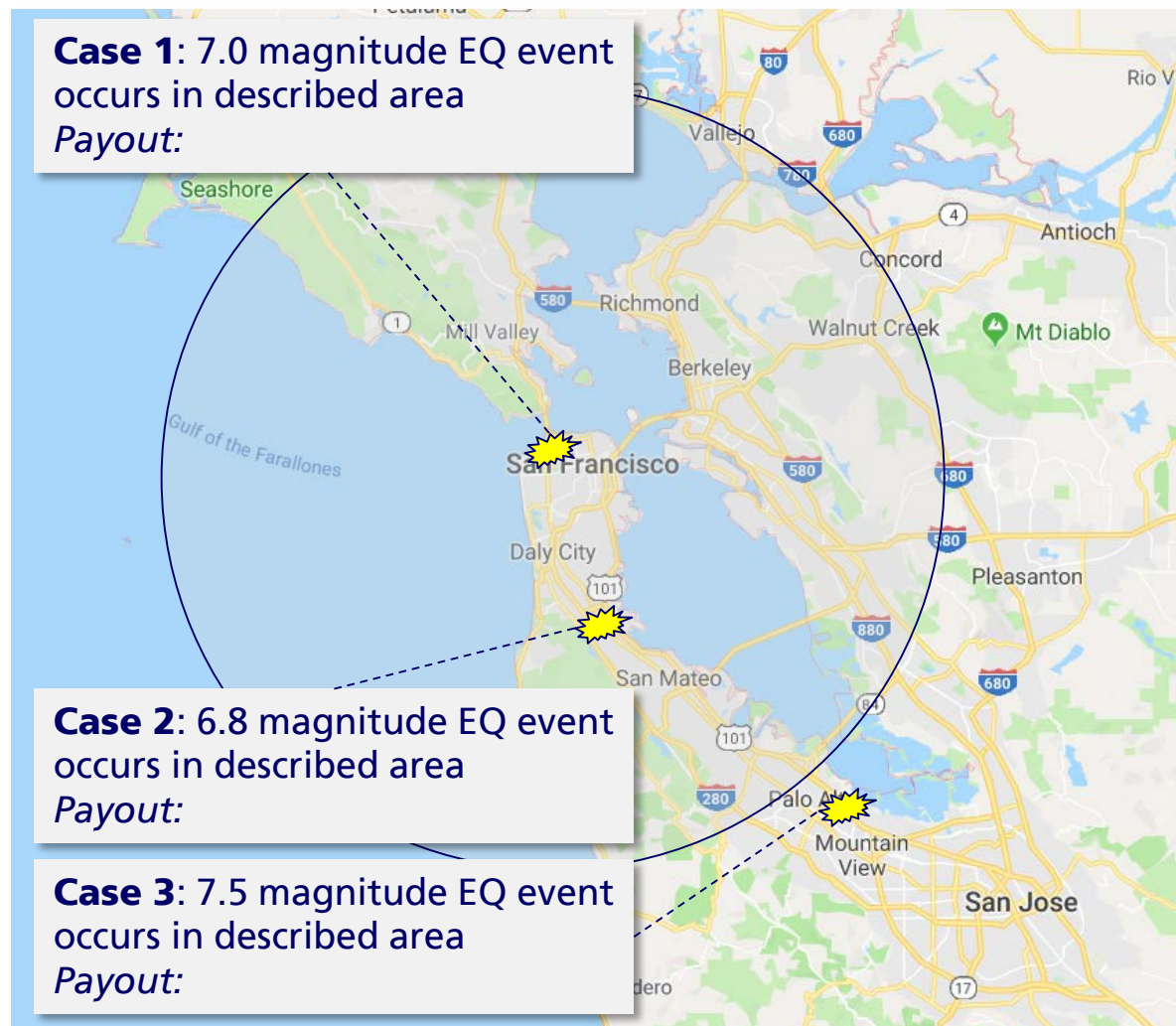
- An EQ event occurs in the described area during the coverage term
- Using USGS data (independent 3rd party), one could determine if the event exceeded the pre-agreed trigger and the epicenter was in the described area
- Once determined that an eligible event has occurred, a payout is made within 30 days of the EQ occurrence data
- In the USA a product like this would need a 'double trigger' to ensure this would be treated like insurance as opposed to a derivative (both the event happens and the insured sustains a loss)

USGS Magnitude Scale	E.g. Payout
< 6.7	\$0
≥ 6.7 to < 7.0	\$20m
≥ 7.0	\$40m

Case 1: 7.0 magnitude EQ event occurs in described area
Payout:

Case 2: 6.8 magnitude EQ event occurs in described area
Payout:

Case 3: 7.5 magnitude EQ event occurs in described area
Payout:



There are multiple reasons why an insured could benefit from a parametric insurance contract (1/2)

Quick claims processing: a benefit to customers and lowers the expense ratio (and price)

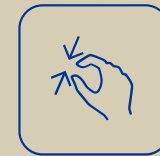


Provides a **solution for climate resilience**¹ and is a potential growth market in the industry²



Addresses the **protection gap** between insured losses and total economic loss from major events

Insuring the uninsurable



Removes adverse selection and adds transparency to both parties through an **objective and independent measure**

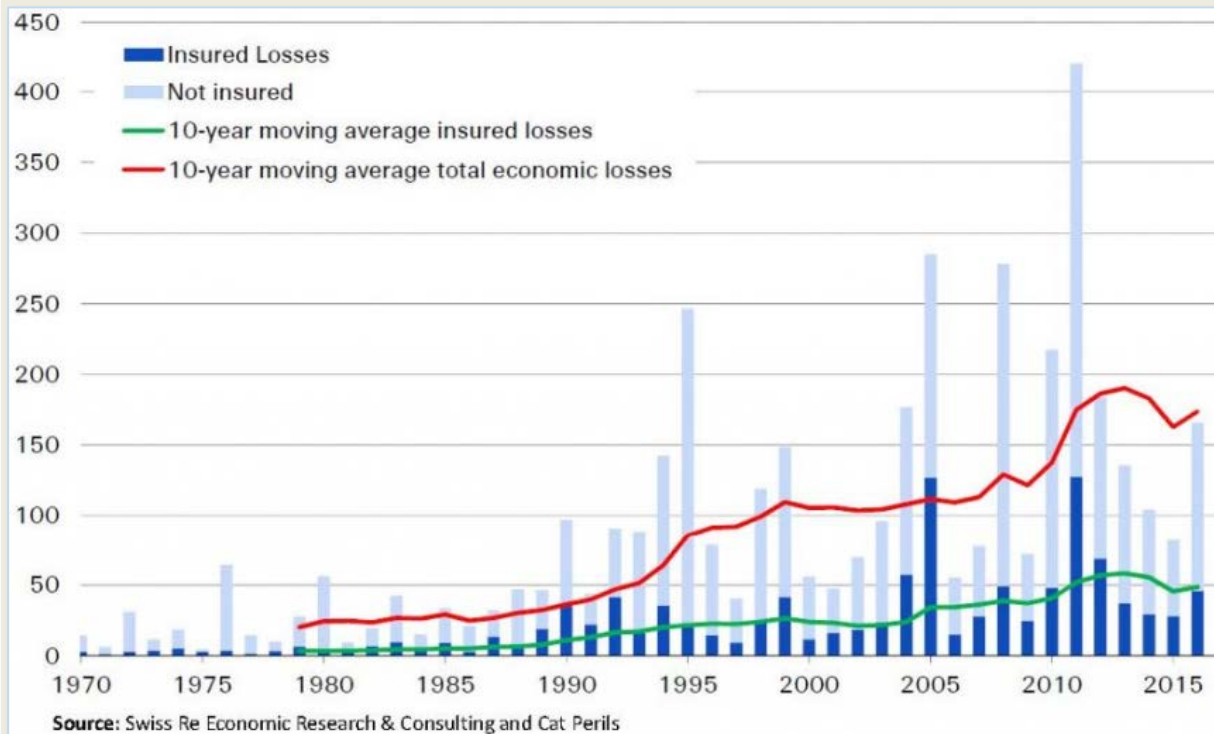


(1) [Parametric Insurance: A Tool to Increase Climate Resilience](#)
(2) [Is parametric insurance a potential growth market in the face of climate change?](#)

There are multiple reasons why an insured could benefit from a parametric insurance contract (2/2)



Natural Catastrophe losses 1970-2016, 2016 \$B USD



2018 protection gap – by region, \$B USD

Region	Insured losses		Economic losses	
	in USD bn	in %	in USD bn	in %
North America	52.9	62.5%	80.5	48.8%
Latin America & Caribbean	1.3	1.5%	4.9	2.9%
Europe	7.7	9.1%	20.7	12.5%
Africa	0.2	0.2%	1.3	0.8%
Asia	20.4	24.0%	54.7	33.2%
Oceania/Australia	1.6	1.9%	2.3	1.4%
Seas / Space	0.6	0.7%	0.7	0.4%
World	85	100.0%	165	100.0%

Economic Losses = Insured + Uninsured Losses

Protection Gap

- 2018 global economic losses from disasters was \$165B USD, up from \$25B USD in 1970 (when records began)
- Only ~50% of those losses were insured, leaving companies and individuals on the hook for more than \$80B USD

... and this, along with new technologies...



Descriptive



Prescriptive



Predictive

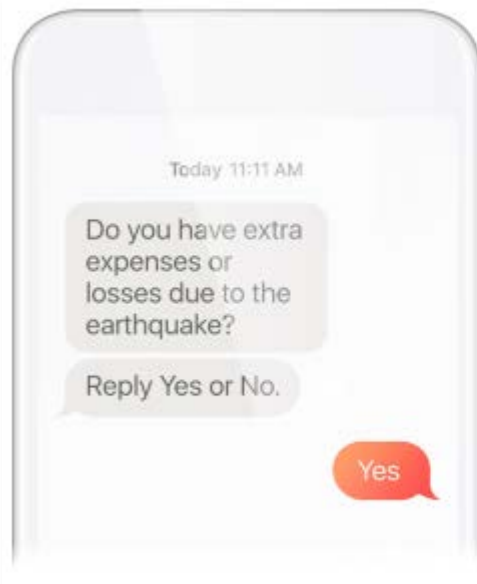


Cognitive

Sources: [Financial Times: Nano-satellites dominate space and spread spies in the skies](#), <https://www.geeksforgeeks.org/machine-learning/>,

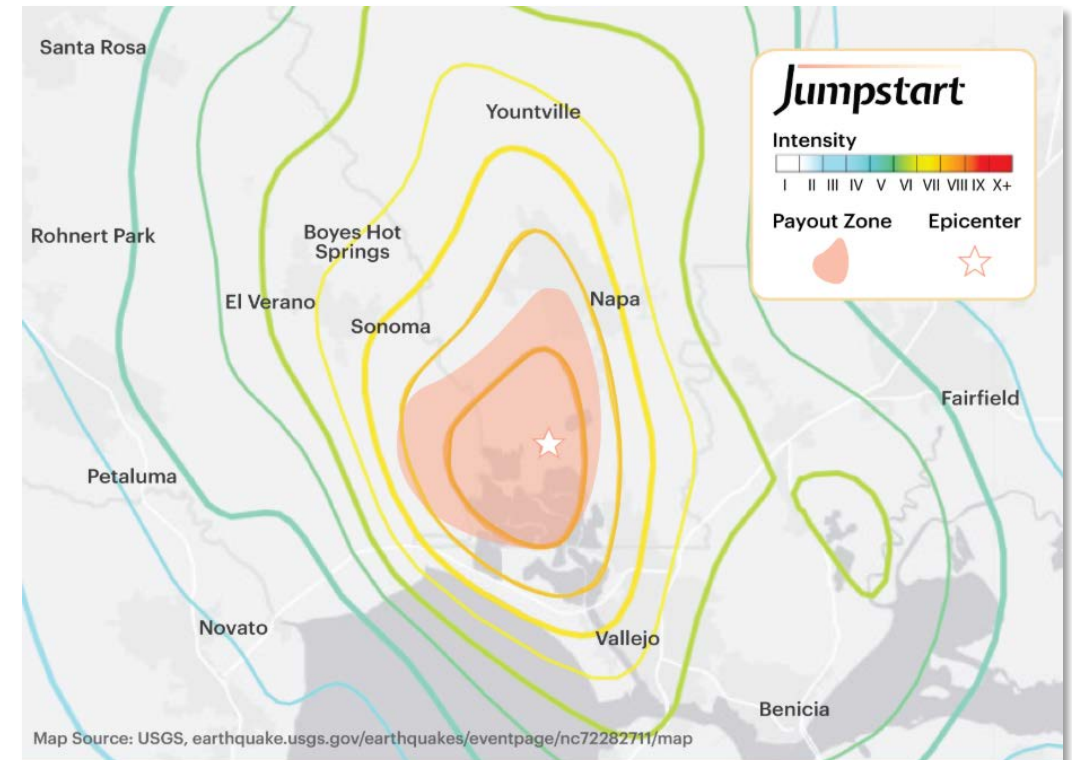
... have allowed insuretech to create value propositions in the space (1/3)

Jumpstart



If an intense quake affects you

You get a text message from Jumpstart. Reply to confirm you'll have expenses. **See example payout maps.**



Example Payouts: South Napa Earthquake

Magnitude 6.0 • August 24, 2014

Payout zone boundary is defined by Peak Ground Velocity (PGV) of 30 cm/sec as reported by the US Geological Survey.

... have allowed insuretech to create value propositions in the space (2/3)



Affordable hail coverage. No claims process.

No adjusters

Revolutionizing the settlement with an instant process after triggering the policy

Quick payout

Cover any economic damage from vehicles, roofs, revenue loss, advertising, and other expenses ASAP

No financial deductibles

Parametric insurance breaks the mold of the insurance industry's antiquated, anti-claim mentality



... have allowed insuretech to create value propositions in the space (3/3)



DISGRACE INSURANCE, REINVENTED.

OLD DISGRACE COVERAGE

SPOTTEDRISK™ DISGRACE COVERAGE

Low limits



Limits starting at \$10 million

Complicated claims process — “Was this a disgrace? How much damage?”



Single parametric trigger with 7-day payout, powered by Public Outcry Index™

Many exclusions based on past behavior



No behavioral exclusions

Tedious application and quoting process



Fast data-driven quoting — all we need is names

Building a parametric solution brings new concerns to light, namely basis risk and product design risk (1/2)

Risks arise when the index measurements do not match the insured's actual losses¹

structured product where **parameter doesn't reflect risk on ground** (notional view of parameter is wrong)



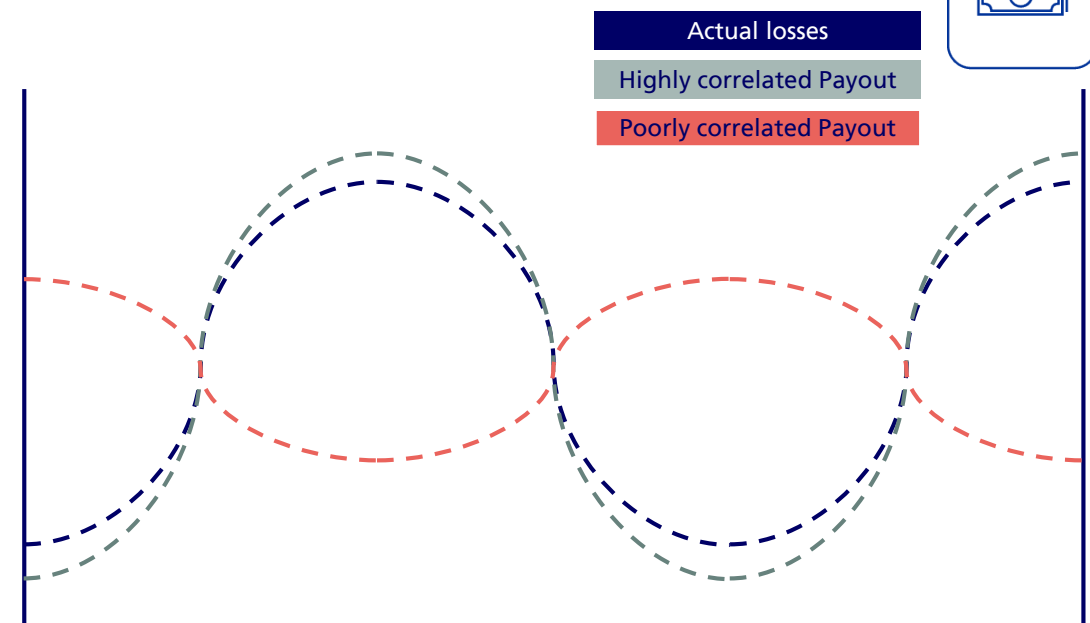
E.g. cloud cover **does not correlate** to production of energy from a wind farm



E.g. cloud cover **does correlate** to production of energy from a solar farm



Payout, based on model, may not match insured's losses and needs



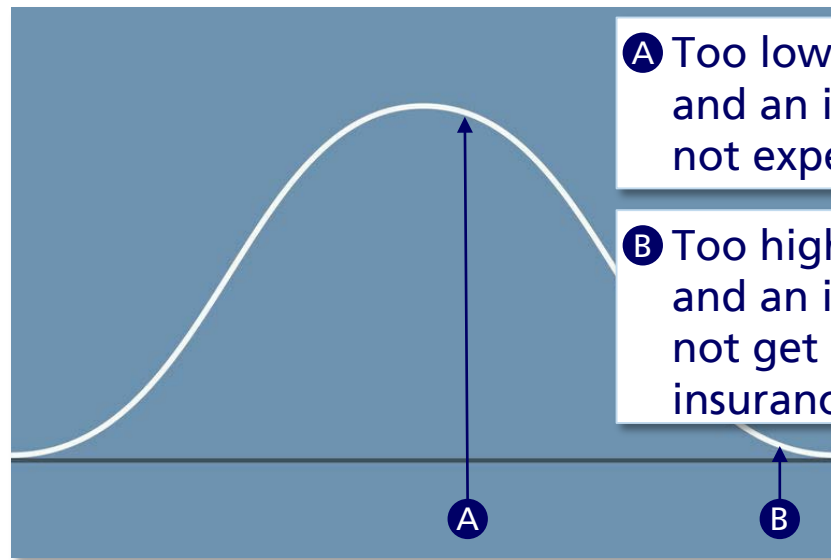
In the United States, an insurance product cannot over enrich an insured. **A double trigger** (both the index is triggered and a loss sustained) ensures the product is not a derivative and can eliminate the product design basis risk

(1) [World Bank Group - Global Index Insurance Facility: What is Basis Risk?](#)
 (2) [National Weather Service - Illinois stations](#)

Building a parametric solution brings new concerns to light, namely basis risk and product design risk (2/2)

Risks arise when the index measurements do not match the insured's actual losses¹

Product design basis risk is minimized through robust product design and backed by testing of contract parameters

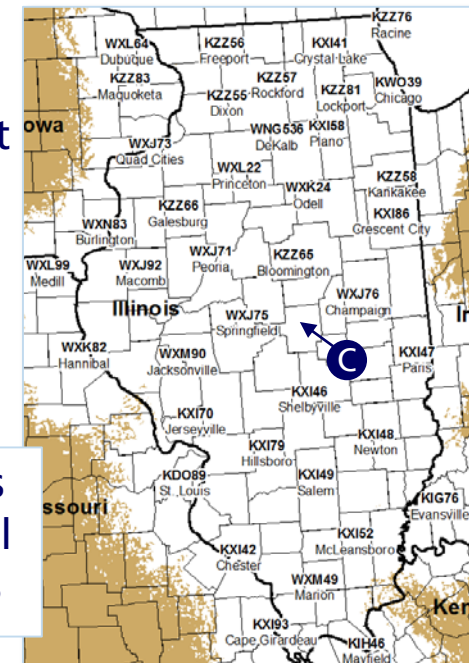


A Too low a trigger and an insured may not experience a loss

B Too high a trigger and an insured may not get benefit from insurance product

Geographical basis risk

is a factor of the distance between the index measurement location and the insured's location

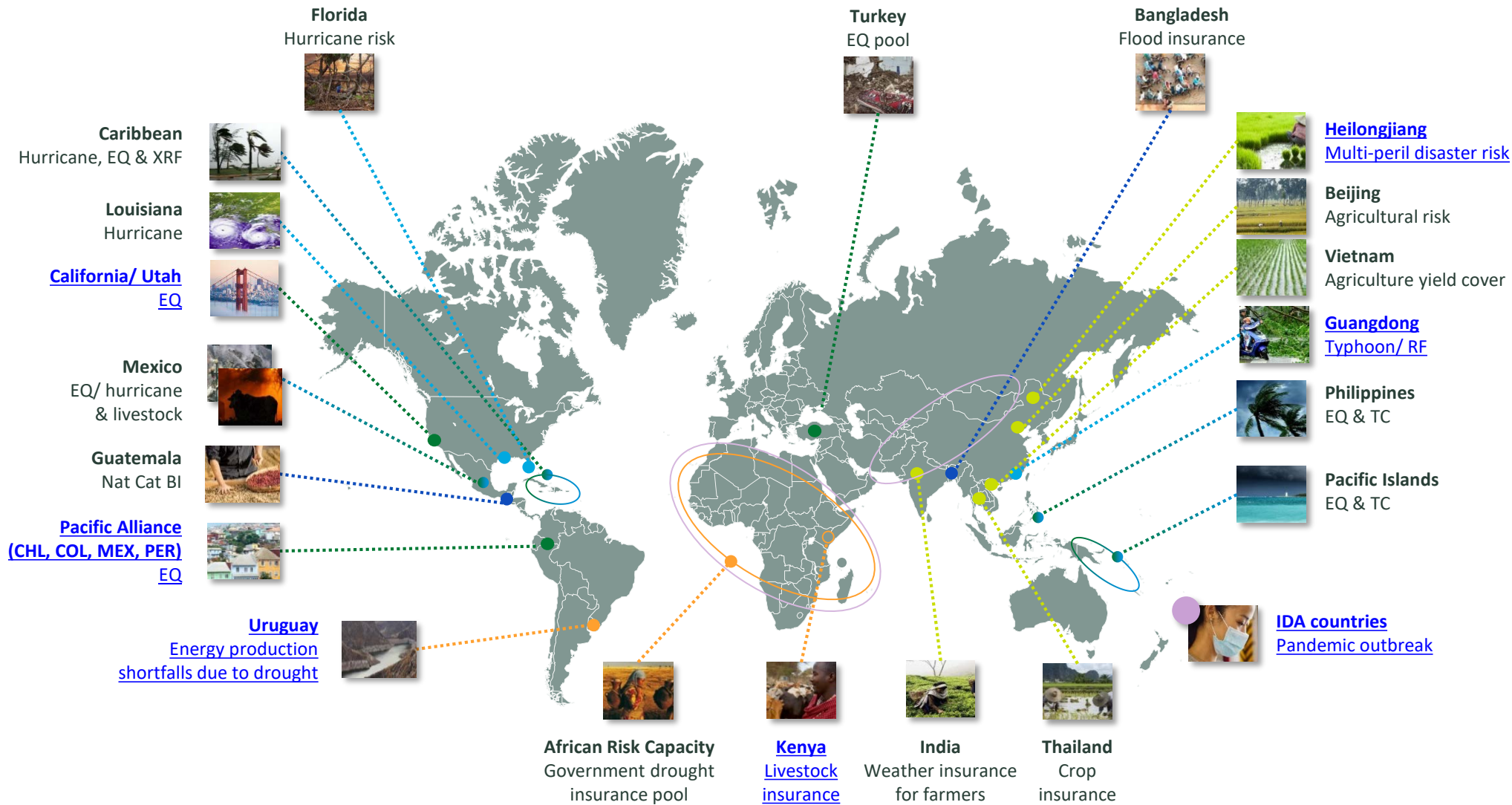


C A risk located here is relatively far from all surrounding stations

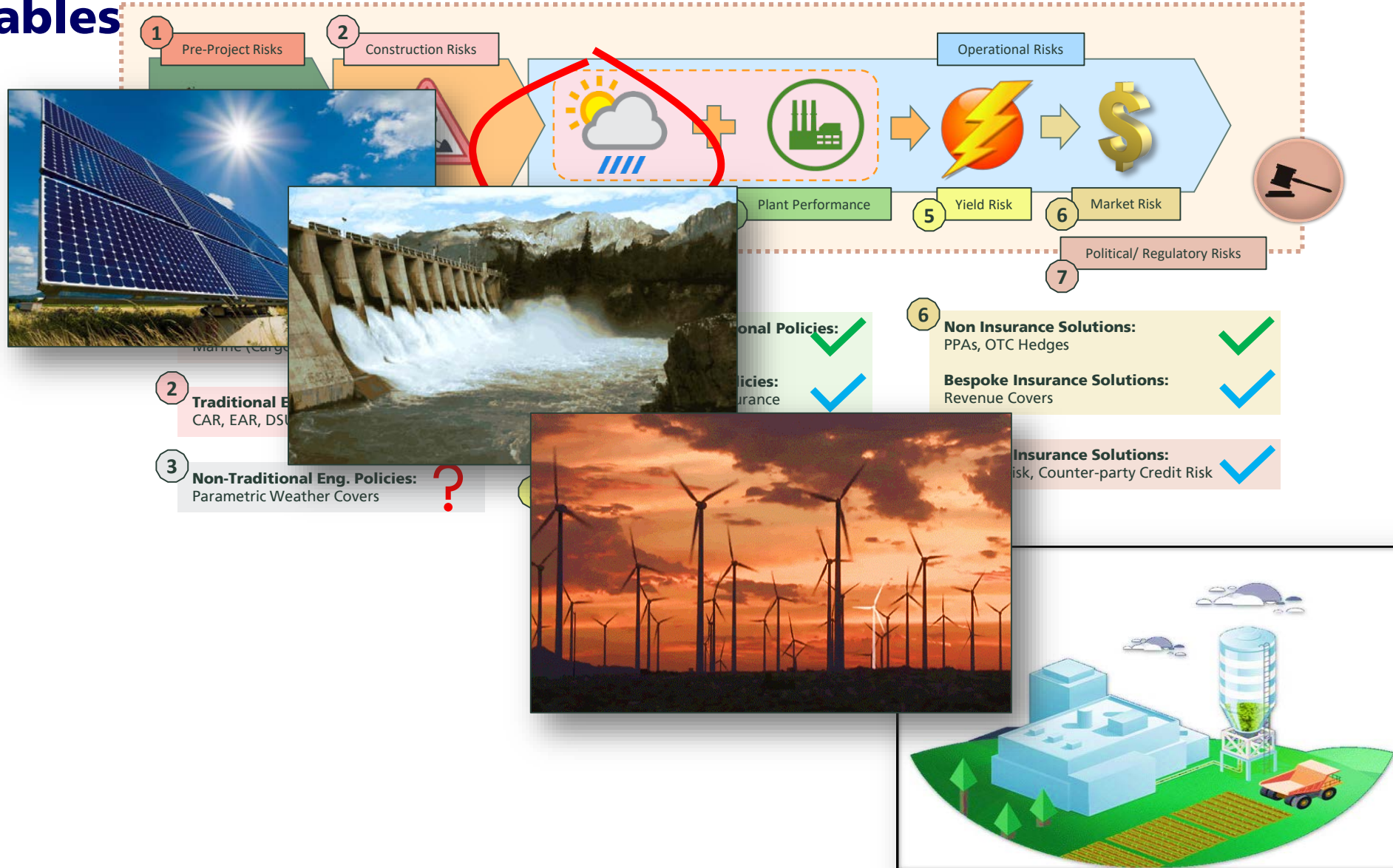
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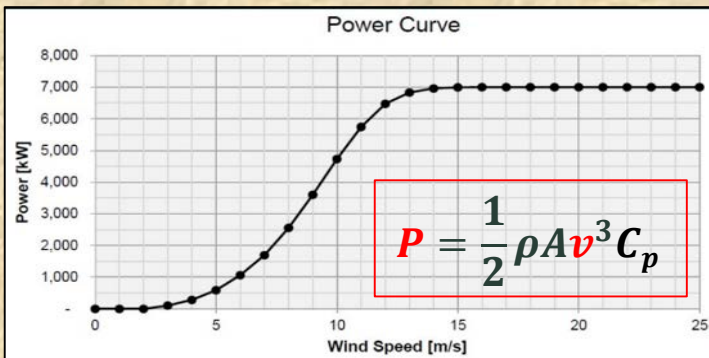
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Examples from Public Sector



Case Study: Parametric Weather Resource Insurance for Renewables

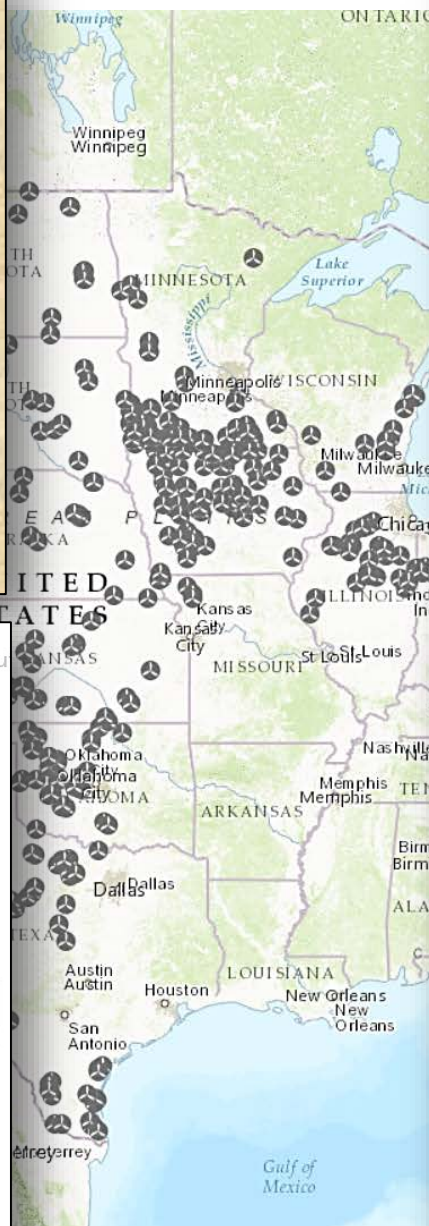
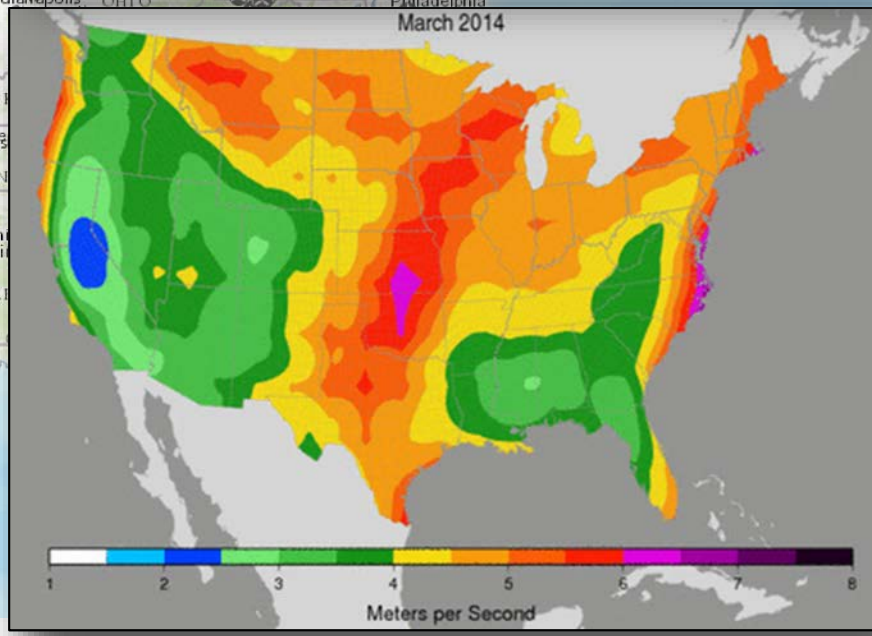


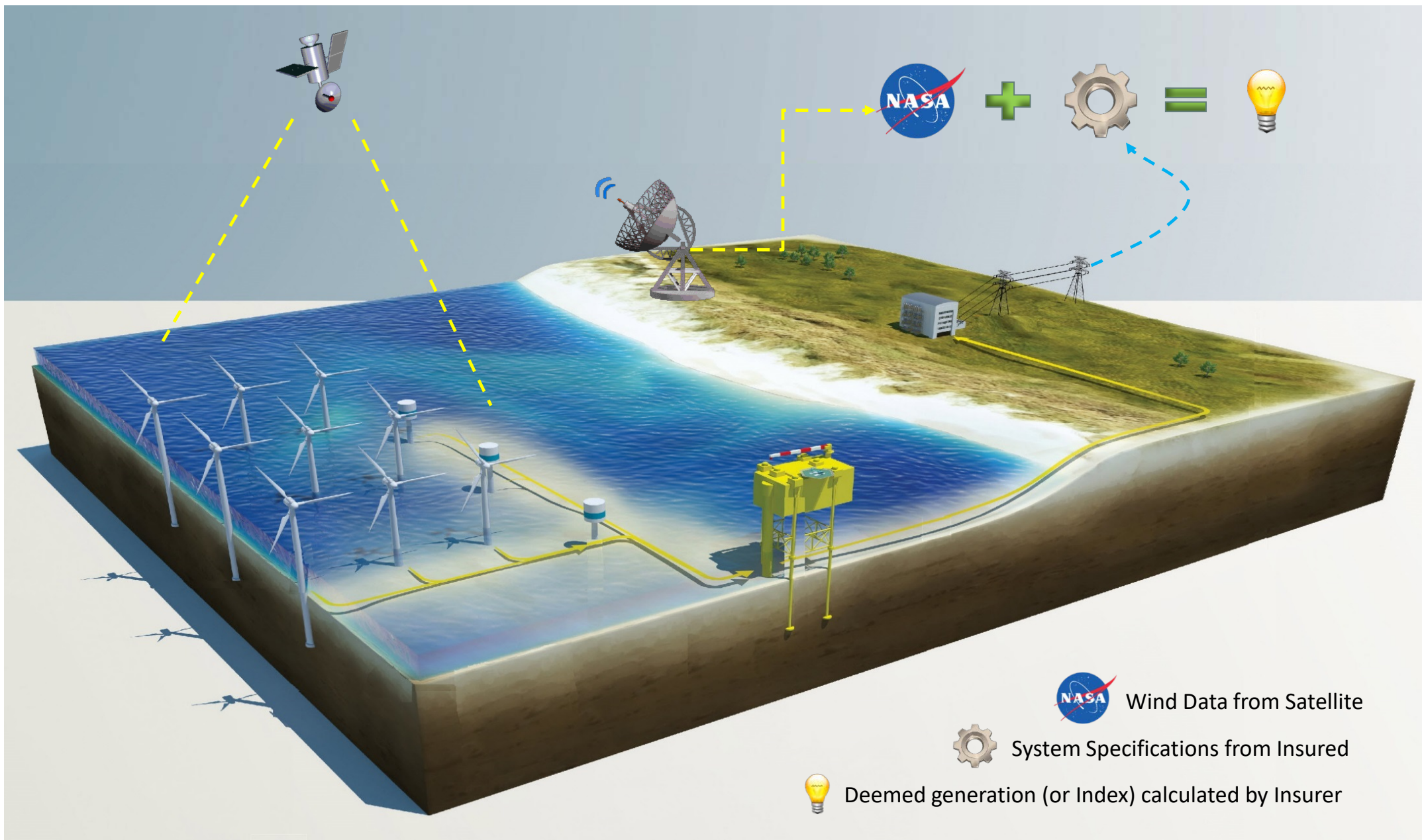


(Power) \propto (Wind)³

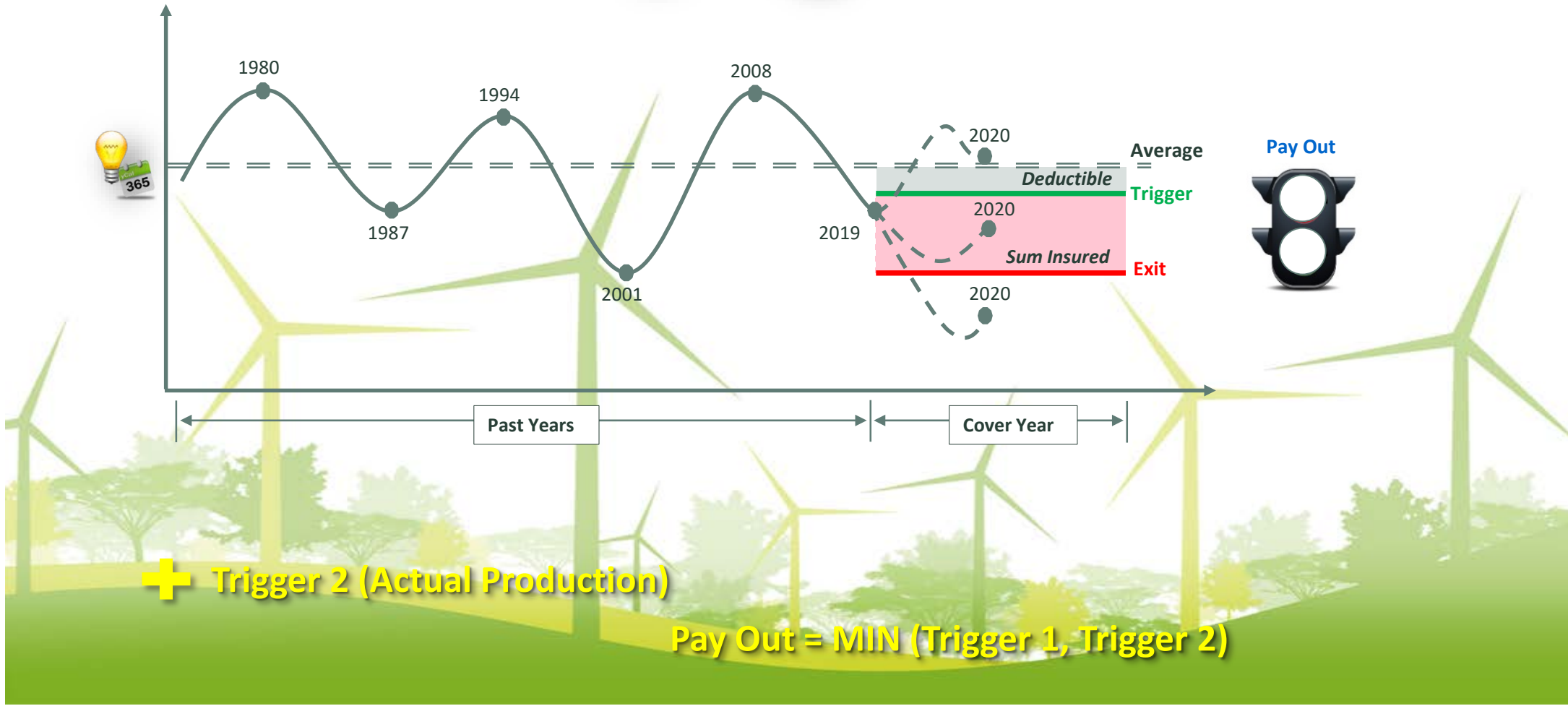
5% ↓ Wind → 15% ↓ Power

\$1,000,000 p.a. ↓ per 30 MW Capacity

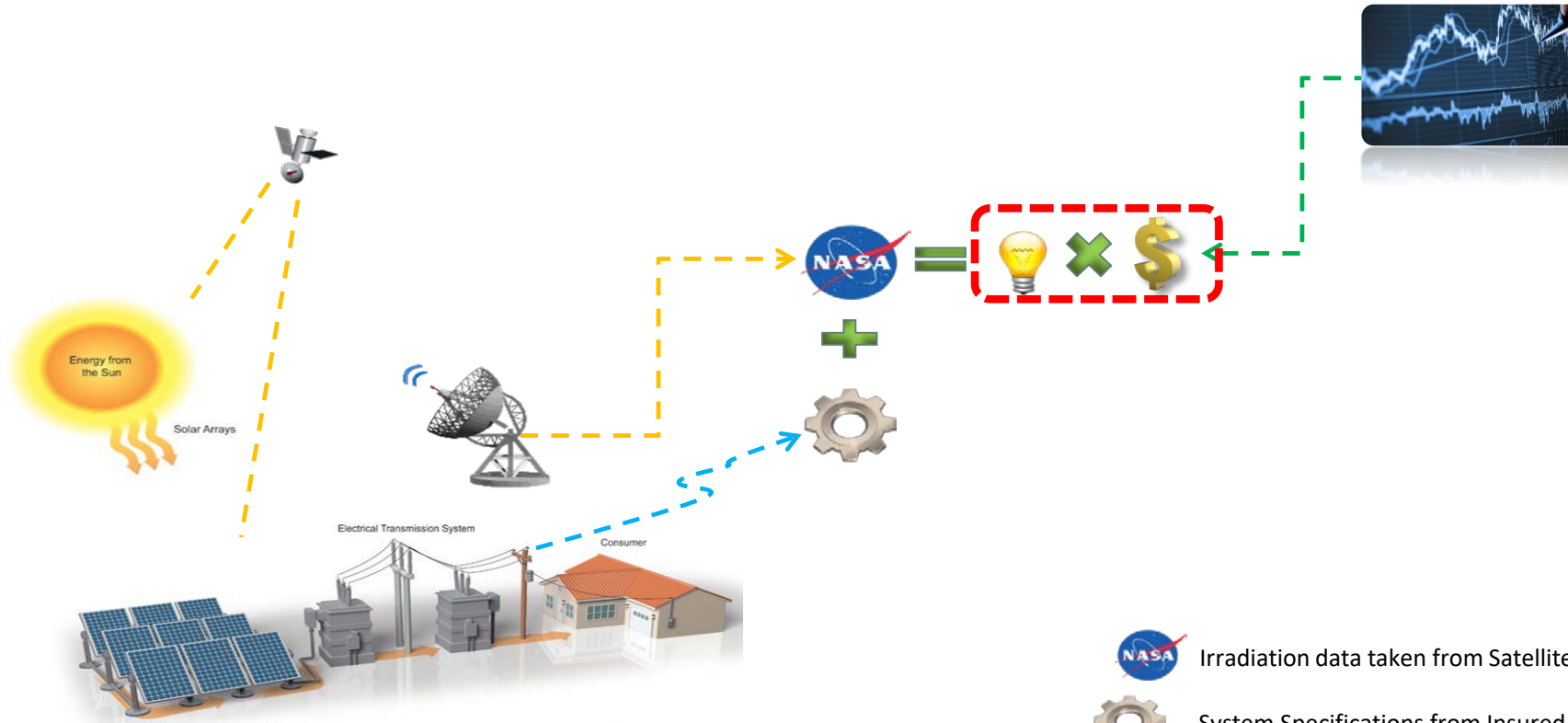





© Zurich



“Revenue Index” can offer protection against both Production & Price Risks

\$ Wholesale or Futures price used as reference






-  Irradiation data taken from Satellite
-  System Specifications from Insured
-  Deemed generation is then calculated

Thank you

Zurich North America & Swiss Re

United States parametric earthquake protection

QUAKE for an earthquake-exposed US state

	Context	Solution	Benefits
	 <p>State exposed to earthquake risk that can cause immense amounts of damage and cost millions in recovery; state has assets in the most-exposed areas.</p> <p>The purpose was to provide cover for the unfunded or underfunded losses resulting from earthquake damages.</p>	<p>QUAKE scheme: two-year solution utilizing shake intensity and various locations in the earthquake exposed counties within the state.</p> <p>Prompt injection of capital totaling USD50m.</p> <p>Purchased as a supplement to a standard property or stand-alone earthquake cover.</p>	<ul style="list-style-type: none"> ➤ Protection against economic loss, covering what FEMA will likely not reimburse ➤ Allows greater customization of the parametric coverage, making it more efficient to buy additional limits or reduce deductibles ➤ The quick pay-out (30 days) improves liquidity and assists with post-event emergency costs
	<p>2nd QUAKE deal to successfully close in the US, 1st with a US state</p>	<p>INSURED</p> <p>Not disclosed</p>	<p>STRUCTURER & INSURER</p> <p>Swiss Re</p> <p>INDEPENDENT DATA PROVIDER</p> <p>US Geological Survey</p>

United States parametric earthquake protection

QUAKE for a public university system

	Context	Solution	Benefits
	<p>The insured university is significantly exposed to earthquake risk.</p> <p>It has numerous campuses and medical centers, with over 500,000 students, faculty and staff.</p> <p>The purpose was to provide cover for the unfunded or underfunded losses resulting from earthquake damage.</p>	<p>QUAKE: three-year solution utilizing shake intensity (>MMI 6.5) and numerous locations across the university system.</p> <p>Provides a prompt injection of capital totaling USD 25m.</p> <p>Purchased as a supplement to a standard property or stand-alone earthquake cover.</p>	<ul style="list-style-type: none"> ➤ Protection against economic loss, covering what FEMA will likely not reimburse ➤ Allows greater customization of the parametric coverage, making it more efficient to buy additional limits or reduce deductibles ➤ The quick pay-out (30 days) improves liquidity and assists with post-event emergency costs.
	<p>1st QUAKE deal to successfully close in the US</p>	<p>INSURED</p> <p>Not disclosed</p>	<p>SOLE STRUCTURER & INSURER</p> <p>Swiss Re</p> <p>INDEPENDENT DATA PROVIDER</p> <p>US Geological Survey</p>



Pacific Alliance sovereign earthquake protection

Four country catastrophe bond

	Context	Solution	Benefits									
	<p>Countries located within one of the most earthquake prone zones in the world, regularly experiencing devastating earthquakes in the past.</p> <p>Governments sought to mitigate the disruptive effects to their budgets and reduce any need for increase of debt or tax.</p> <table border="1" data-bbox="586 899 968 1028"> <tr> <td rowspan="4">Coverage</td> <td>Chile</td> <td>\$500m</td> </tr> <tr> <td>Colombia</td> <td>\$400m</td> </tr> <tr> <td>Mexico</td> <td>\$260m</td> </tr> <tr> <td>Peru</td> <td>\$200m</td> </tr> </table>	Coverage	Chile	\$500m	Colombia	\$400m	Mexico	\$260m	Peru	\$200m	<p>The World Bank issued the largest-ever sovereign sponsored catastrophe bond.</p> <p>Sum insured: USD 1'360m for 3 years, covering the risk faced by the four countries.</p> <p>Parametric trigger product: cat-in-the-grid earthquake magnitude threshold.</p>	<ul style="list-style-type: none"> ➤ Faster recovery from major earthquakes and protection of economic development in the immediate aftermath ➤ Payouts guaranteed within a few weeks upon qualifying events ➤ Coverage is customized, in line with their exposure and overall disaster risk financing strategy
Coverage	Chile		\$500m									
	Colombia		\$400m									
	Mexico		\$260m									
	Peru	\$200m										
<p>SPONSOR & ISSUER World Bank</p>		<p>INSURED Governments of Chile, Colombia, Peru and Mexico</p>	<p>MODELLING & CALCULATION AIR Worldwide</p>	<p>DATA PROVIDER US Geological Survey</p>	<p>RISK TAKER Capital market investors</p>	<p>STRUCTURING & PLACEMENT Swiss Re & others</p>						



Uruguay hydropower drought cover

Largest energy risk transfer to protect against drought risk

	Context	Solution	Benefits						
	<p>Hydro power: Uruguay's main energy source, supplying up to 90% of the country's electricity demand.</p> <p>A dry year can be costly: the country relies on imports of crude oil and electricity from Argentina and Brazil, thus draining the state budget.</p> <p>Uruguay decided to decrease this uncertainty and provide an efficient back-up solution in case of droughts.</p>	<p>USD 450m weather coverage agreement, the largest of its kind in the weather risk management market.</p> <p>A payout is triggered when water levels fall to a pre-determined point. The amount depends on drought severity and the 6-month daily average of crude oil prices.</p> <p>The payout is used to purchase alternative energy to make up for the hydropower shortfall.</p>	<ul style="list-style-type: none"> ➤ Reduces budget uncertainty for the Government of Uruguay while at the same time guaranteeing a reliable source of power to Uruguay's citizens ➤ Easily replicable structure, could provide protection for other perils (excess rainfall, heat, frost, wind speed) as well as for price fluctuations in commodities 						
<table border="0" style="width: 100%; text-align: center;"> <tr> <td style="width: 33%;">CLIENT</td> <td style="width: 33%;">ARRANGER</td> <td style="width: 33%;">RISK TAKERS</td> </tr> <tr> <td>UTE (Uruguayan state-owned company)</td> <td>World Bank Treasury</td> <td>Swiss Re and Allianz</td> </tr> </table>				CLIENT	ARRANGER	RISK TAKERS	UTE (Uruguayan state-owned company)	World Bank Treasury	Swiss Re and Allianz
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Kenya Livestock Insurance Program (KLIP)

Livestock protection for smallholder farmers in Kenya

	Context	Solution	Benefits				
	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <p>The majority of Kenyan population lives in rural areas, depending on the land and livestock to make a living.</p> <p>Climate change and resulting droughts, which are gaining in frequency and severity, pose an existential threat to Kenyan pastoralists.</p> <p>The government decided to find a solution to help them bring their cattle through periods of drought.</p> </div>	<p>KLIP: index-based livestock insurance scheme, launched in 2015 in 2 counties covering livestock of 5,000 households. Expanded since and in 2018 covered 8 counties, 18,000 households and 90,000 livestock units.</p> <p>Once the NDVI* index reaches a certain threshold, insured pastoralists receive a lump sum payout to purchase food and water for the livestock.</p> <div style="text-align: center; margin-top: 20px;"> <p>2017: USD 5.1 m paid out to the pastoralists</p> </div>	<ul style="list-style-type: none"> ➤ Timely financial support provided to pastoralists, who protect their cattle from drought effects in the first place ➤ Tailored to prevent the loss of the cattle and farmers' livelihood ➤ 100% funded by the government, covering 5 tropical livestock units per household 				
<table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center; vertical-align: top;"> <p>FRAMEWORK & PREMIUM PAYMENT</p> <p>Ministry of Agriculture</p> </td> <td style="width: 25%; text-align: center; vertical-align: top;"> <p>INSURER</p> <p>Takaful Insurance (previously APA-led insurance consortium)</p> </td> <td style="width: 25%; text-align: center; vertical-align: top;"> <p>MODELLING</p> <p>International Livestock Research Institute (ILRI) funded by World Bank</p> </td> <td style="width: 25%; text-align: center; vertical-align: top;"> <p>Reinsurance</p> <p>Swiss Re & Other</p> </td> </tr> </table>				<p>FRAMEWORK & PREMIUM PAYMENT</p> <p>Ministry of Agriculture</p>	<p>INSURER</p> <p>Takaful Insurance (previously APA-led insurance consortium)</p>	<p>MODELLING</p> <p>International Livestock Research Institute (ILRI) funded by World Bank</p>	<p>Reinsurance</p> <p>Swiss Re & Other</p>
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<p>*The Normalized Difference Vegetation Index (NDVI) is an index of plant "greenness" or photosynthetic activity.</p>							



China multi-peril parametric disaster relief coverage for Heilongjiang provincial government

	Context	Solution	Benefits
	<p>Heilongjiang Department of Finance very active in its endeavor to develop an catastrophe insurance system, focusing on agricultural insurance and food safety.</p> <p>The provincial government decided to insure its fiscal contingent liabilities for disaster relief.</p> <p>The focus of the pilot were 28 counties which lagged behind in terms of poverty resilience.</p>	<p>A quota share reinsurance cover, for a sum insured of USD 360m.</p> <p>Swiss Re participates with 80% to the scheme.</p> <p>Parametric trigger designed to reflect yield losses of agricultural crops based on satellite flood footprint index, precipitation index, drought (temperature & precipitation) and low temperature.</p>	<ul style="list-style-type: none"> ➤ Payouts used for disaster relief and post disaster reconstructions of infrastructure ➤ Insured counties can bear unforeseeable expenses resulting from catastrophic events despite the limited resources they otherwise dispose of
<p>REINSURER & PRODUCT DESIGN</p> <p>Swiss Re</p>		<p>CALCULATION AGENT</p> <p>China Meteorological Agency</p>	<p>INSURED</p> <p>Sunlight Agro Mutual Insurance</p>





China parametric disaster relief hedge for Guangdong provincial government

	Context	Solution	Benefits		
	<p>Guangdong: frequently hit by tropical cyclones and excessive rainfall.</p> <p>Pearl river delta is one of the fastest growing urban regions globally.</p> <p>The local government teamed up with local partners and Swiss Re to design advanced insurance solutions for the region to improve its resilience.</p>	<p>Parametric cover with a double trigger: typhoon track & wind speed for cyclone risk; precipitation amount for heavy rainfall risk.</p> <p>Sum insured of USD 340m for pilot 10 cities.</p> <p>Implemented in 2016, the cover is to be renewed annually and extended to other cities in 2017.</p>	<ul style="list-style-type: none"> ➤ Supports Guangdong province in building fiscal resilience against Nat Cat contingent liability ➤ Payouts used to support local authorities' expenses for disaster relief and post disaster reconstruction of property and infrastructure 		
<p>October 2016: payout of USD 3.2m after Typhoon Haima and heavy rainfall</p>					
<p>INSURED</p> <p>10 municipal governments in Guangdong province</p>		<p>PROJECT TEAM</p> <p>Guanddong MoF (lead), CIRC, NDRC, MoCA, CMA*</p>	<p>LOCAL INSURANCE PARTNER (Lead)</p> <p>PICC</p>	<p>PRODUCT DESIGN & REINSURER</p> <p>Swiss Re</p>	<p>METEOROLOGICAL MEASURES</p> <p>Guangdong Climate Center</p>
<p>*CIRC (China Insurance Regulatory Committee), NDRC (National Development and Reform Committee), MoCA (Ministry of Civil Affairs), CMA (China Meteorological Administration)</p>					



Pandemic Emergency Financing Facility (PEF)

Pandemic preparedness & health security for IDA countries

	Context	Solution	Benefits			
	 <p>Following the Ebola crisis (2014), the G7, World Bank and WHO committed to develop a more robust global pandemic risk management framework.</p> <p>2016: WB mandated Swiss Re as one of its partners to create an insurance / investment product to address this funding gap and devise a solution that enables the transfer of pandemic risk to the private markets.</p>	<p>PEF: first ever parametric insurance cover for response costs to pandemics in 75 poorest countries (IDA).</p> <p>Covers diseases such as New influenza, Corona- and Filoviruses (e.g. Ebola).</p> <p>Sum insured is USD 425m in both swap and bond form.</p> <p>Cover is triggered once the viruses reach a certain level of contagion as defined by the number of cases, speed of spread, geography, etc.</p>	<ul style="list-style-type: none"> ➤ Advancing the global health security ➤ PEF leverages capital markets to fill pandemic response funding gap before large scale donor funding is mobilized ➤ Improves transparency and accountability in global and national response efforts, to reduce overall costs and ultimately save lives 			
	<p>SPONSOR & INSURED</p> <p>World Bank (IDA countries)</p>	<p>MAJOR DONORS</p> <p>Germany & Japan</p>	<p>RISK MODELLING</p> <p>AIR Worldwide</p>	<p>REPORTING AGENCY</p> <p>World Health Organization</p>	<p>RISK TAKER</p> <p>Re-/insurers & capital markets</p>	<p>SWISS RE</p> <p>Co-structurer, lead placement agent & sole book runner</p>



Parametric Overview – Payout Mechanisms

Pay-out Mechanism

- A pre-agreed pay-out if the parameter or index threshold is reached or exceeded, regardless of actual physical loss sustained
 - The threshold is usually set in such way that it aligns with a client's own business continuity plan and risk tolerance
- Clients can choose a structure (deductible, maximum payout) that best meets their needs
- The deductible / payout at which the insurance kicks in can be structured in different ways:

Binary: the full limit is paid when an index value above or below a pre-defined threshold is recorded

Alternatively, payout can be linked to the severity or magnitude of an event (e.g Category 4 cyclone triggers XX% of the limit while a Category 5 cyclone pays YY%)

Linear: Payout size increases incrementally as the index value changes

- When written in insurance form, in the future, generally within 12 months of the event, insured needs to certify that actual covered losses and expenses are greater than or equal to the payout received
- Payouts may be subject to a max limit per event and term aggregate limit

Customer benefits of parametric solutions over traditional



Benefits	Description
Certainty	Simple and transparent claims process. When certain conditions are met, insured has certainty that a financial payment will be made and the amount that it will be paid.
Speed	<p>Once a threshold is reached, claims can be paid in days or, at most, weeks (vs typically months or even years with traditional indemnity covers).</p> <p>As blockchain technology become more widely adopted, it is possible that over time it will be possible to embed the parametric triggers into the payment system so that payouts are made automatically and potentially in seconds</p>
Bespoke	Each policy covers specific locations / facilities defined by the client, and the individual program structures – index values, payout formula, and coverage limits – are customized to the client’s strategic objectives, risk appetites, and budgets
Insuring the uninsurable	Covers underinsured or uninsured risk; at times it can be challenging to cover a particular risk because it is located somewhere that is hard to get to or hard to get data because the local insurance market is not well developed. With global satellites, we have weather data across the Earth and therefore one can develop coverages for wherever they are needed