

CEADIR DISCUSSION SERIES

**Navigating the
Climate Economy:
Investing for Growth and
Resilience**

**Using Parametric Insurance to
Reduce Climate Risks of
Renewable Energy Resources**

October 1, 2020

Santiago Enriquez, *Abt Associates*
Álvaro Núñez, *Munich Re Trading*
Sebabrata Sarkar, *Swiss Re America*

Moderator: **Pablo Torres**, *Crown Agents USA*

This presentation was made possible by the support of the American People through the United States Agency for International Development (USAID) and was prepared by Crown Agents-USA and Abt Associates for the Climate Economic Analysis for Development, Investment, and Resilience (CEADIR) Activity. The authors' views do not necessarily reflect the views of the United States Agency for International Development (USAID) or the United States Government.



Pablo Torres

- CEADIR Chief of Party, Crown Agents USA
- Over 15 years of international development experience
- Analyst for the Climate Investment Funds in 2013-2014
- Master of Environmental Management from Yale School of the Environment

AGENDA

Welcome and introduction

Pablo Torres, *Crown Agents USA*

CEADIR's parametric research in Central America

Santiago Enriquez, *Abt Associates*

Worldwide parametric applications and best practices

Sebabrata Sarkar, *Swiss Re*

Industry insights and use cases from Latin America

Álvaro Núñez, *Munich Re Trading*

Q&A Forum

The image shows the cover of a report. At the top left is the USAID logo with the text 'FROM THE AMERICAN PEOPLE'. The title 'PARAMETRIC INSURANCE FOR RENEWABLE ELECTRIC POWER PRODUCERS IN CENTRAL AMERICA' is written in large white letters on a dark blue background. Below the title is the subtitle 'CLIMATE ECONOMIC ANALYSIS FOR DEVELOPMENT, INVESTMENT, AND RESILIENCE (CEADIR)'. Underneath the subtitle is the contract number 'Contract No. AID-OAA-I-12-00038, Task Order AID-OAA-TO-14-00007'. The central part of the cover features a satellite-style map of Central America with green outlines of the countries: Mexico, Guatemala, Honduras, and Nicaragua. The map also shows the Pacific Ocean to the west and the Caribbean Sea to the east. At the bottom of the cover, there is a date 'September 3, 2020' and a paragraph of text: 'This report was made possible by the support of the American people through the United States Agency for International Development (USAID). It was prepared by Crown Agents USA and Abt Associates.'



Santiago Enriquez

- Senior Climate Change and Environmental Specialist at Abt Associates
- More than 18 years of experience designing and implementing clean energy, sustainable landscape, and environmental projects
- Managed \$2.6 million Technical Assistance to Mobilize Clean Energy Investment in Central America
- Master's in Public Policy from Harvard University

APPROACH

- In 2017, CEADIR completed 48 interviews in El Salvador, Guatemala, Honduras, and Panama
 - 20 RE companies (many owned multiple renewable electric power facilities).
 - 14 banks
 - Three RE business associations
 - Two insurance associations
 - Two banking associations
 - Four insurance companies
 - Three regulatory agencies
- Interviewed RE companies in Panama represented 62% of installed capacity, the highest among the four countries

RESOURCE AVAILABILITY FOR ELECTRIC POWER

- Hydropower, solar and wind power are intermittent resources subject to daily, seasonal, and annual variability in electricity generation.
- Weather variability can cause major fluctuations in the amount and timing of electricity generation, affecting
 - Revenues
 - Contract penalties
 - Capacity to repay loans or other financing and operating costs.
- Cash flow fluctuations can affect ability to obtain financing by increasing credit risks
- Climate change is expected to increase the frequency and magnitude of droughts and extreme rain events at the global level
 - Effects in specific locations are difficult to predict.

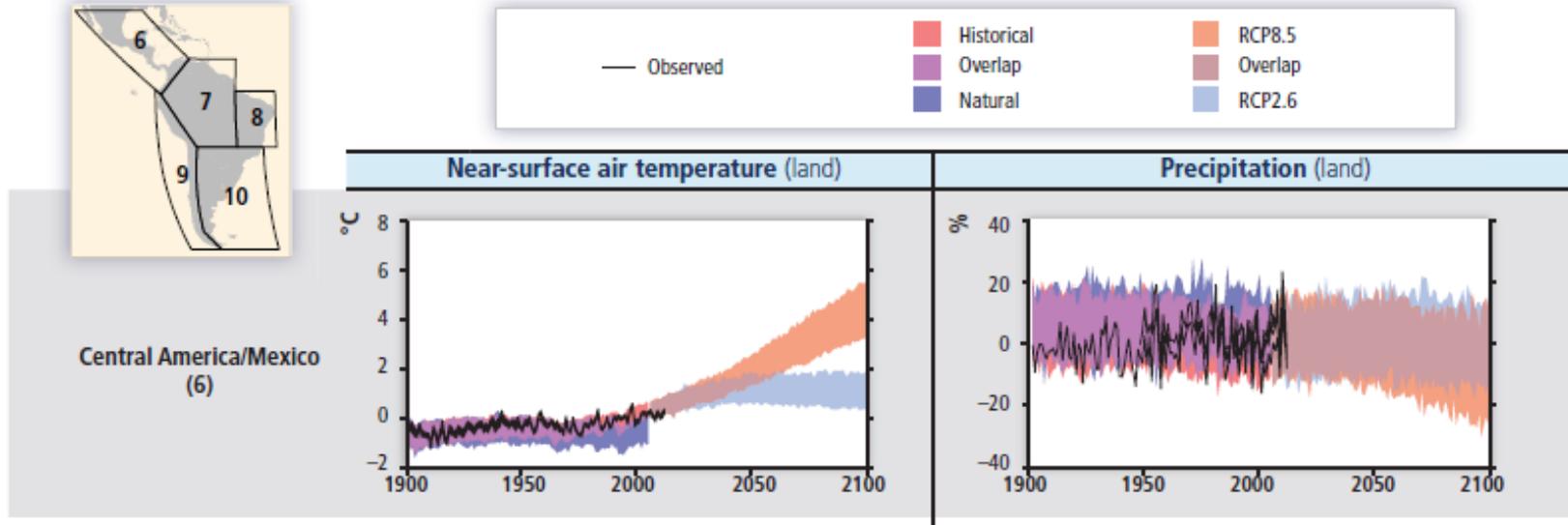
WEATHER AND CLIMATE RISKS FOR HYDROPOWER, WIND POWER, AND PHOTOVOLTAICS

Type of Risk	Hydropower	Wind Power	Photovoltaics
Excessive flows	High rainfall or river flows damage dams, catchments, engine house, canals, roads, or other physical works	<ul style="list-style-type: none"> • High winds damage turbine blades or towers • High rainfall or other precipitation causes landslides or floods that damage turbines, towers, roads, or distribution lines 	High rainfall or other precipitation causes flooding or landslides that damage panels, structures, roads, or distribution lines
Deficit flows	<ul style="list-style-type: none"> • Low water levels in run-of-river or reservoir systems reduce electricity generation and sales • Competition with other users for river water decreases the volume available for power generation or pumped storage 	Insufficient wind reduces electricity generation and sales	Insufficient solar flux reduces electricity generation or sales

WEATHER AND CLIMATE RISKS FOR RENEWABLE ENERGY POWER IN CENTRAL AMERICA

- Climate change is expected to increase average and maximum local temperatures in Central America.
- It is more difficult to estimate the effects of global warming on precipitation and winds than on temperatures.
- Global warming may increase rainfall in some areas and decrease it in others.
- Climate change is also likely to increase the frequency of extreme weather events and affect timing and duration of dry and rainy seasons.

PROJECTED CHANGES IN LAND TEMPERATURES AND PRECIPITATION IN CENTRAL AMERICA THROUGH 2100



Source: Hewitson *et al.* 2014

PURPOSE, CHARACTERISTICS AND DESIGN OF PARAMETRIC INSURANCE

- Provides policyholders a predefined, fixed amount of money when insufficient or excessive RE resource flows reach an agreed threshold as documented in standard, available local data on rainfall, wind, or solar flux
- May specify several payment amounts associated with different levels of deficits or excessive RE resources
- Can be less expensive than insurance based on actual assessed damages because it eliminates the administrative costs and litigation potential of the claims adjustment process

ILLUSTRATIVE EXAMPLE OF PARAMETRIC INSURANCE FOR LARGE-SCALE HYDROPOWER

- Assumptions
 - Three weather stations located in or near reservoir-based hydropower system's river basin provide data that are averaged and correlated with historical satellite information
 - 96 percent correlation between rainfall and hydroelectric generation
 - Hydropower capacity of 100 MW per hour in the absence of a drought
 - 95 percent capacity use rate for 24 hours per day
 - Wholesale electricity price of \$0.10/KWh

ILLUSTRATIVE EXAMPLE OF PARAMETRIC INSURANCE FOR LARGE-SCALE HYDROPOWER (2)

- Policy terms
 - One-year policy at a cost of \$5,000,000
 - Agreed weather parameter: Total rainfall during the normal six-month dry season
 - Average historical rainfall during the dry season: 900 mm
 - Insurance payout trigger level: Less than 750 mm of rain during the six-month period
 - Payout: \$100,000 per mm of rain below the trigger level
 - Exit level: No additional payout beyond the amount for 600 mm if dry season rainfall is below this level
- Payout in a drought year with 720 mm of rain during the six-month critical period
 - Claim: $750 \text{ mm (trigger)} - 720 \text{ mm (actual rainfall)} = 30 \text{ mm}$
 - Payout: $30 \text{ mm} \times \$100,000/\text{mm} = \3 million
 - Exit level payout: $(750 \text{ mm} - 600 \text{ mm}) \times \$100,000 = \$15 \text{ million}$

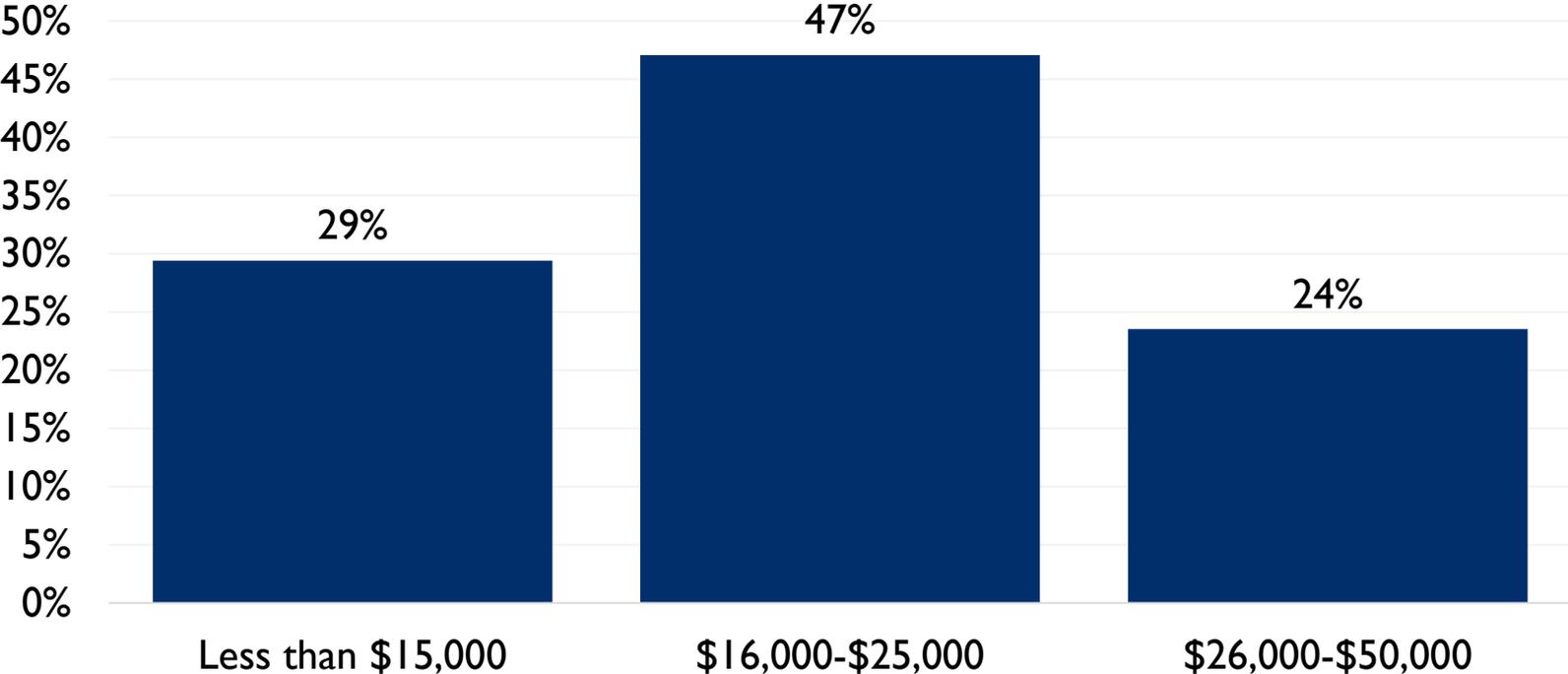
HYPOTHETICAL REVENUES FROM HYDROPOWER SALES AND PARAMETRIC INSURANCE PAYOUTS

Dry Season Rainfall (mm)	Difference Between Actual Rainfall and the Trigger Amount Up to the Exit Level (mm)	Parametric Insurance Payouts (U.S. Dollars)	Average Daily Power Generation (MWh)	Wholesale Power Sales (U.S. Dollars)	Wholesale Power Sales Plus Parametric Insurance Payouts (U.S. Dollars)	Gross Revenues After Parametric Insurance Cost (U.S. Dollars)
600	150	\$15,000,000	456	\$8,322,000	\$23,322,000	\$18,322,000
690	60	\$6,000,000	1,026	\$18,724,500	\$32,966,000	\$27,966,000
720	30	\$3,000,000	1,824	\$33,288,000	\$36,288,000	\$31,288,000
750	0	\$0	2,280	\$41,610,000	\$41,610,000	\$36,610,000
900	0	\$0	5,382	\$98,221,500	\$98,221,500	\$93,221,500

INTERVIEWEE PERCEPTIONS ABOUT CHANGES IN CLIMATE RISKS (PERCENT OF INTERVIEWEES)

Perceived Change in Climate Risks	RE Companies (Fewer Than Five Years)	RE Companies (Five to 20 years)	Banks and Insurance Companies (Up to Five Years)	Banks and Insurance Companies (Five to 20 Years)
Decreasing	10%	10%	0%	11%
Not changing	45%	10%	33.3%	0%
Increasing	30%	70%	44.4%	61%
Do not know	15%	10%	22.2%	28%
Total	100%	100%	100%	100%

ANNUAL WILLINGNESS TO PAY FOR PARAMETRIC INSURANCE (PERCENT OF INTERVIEWEES)



OTHER KEY FINDINGS

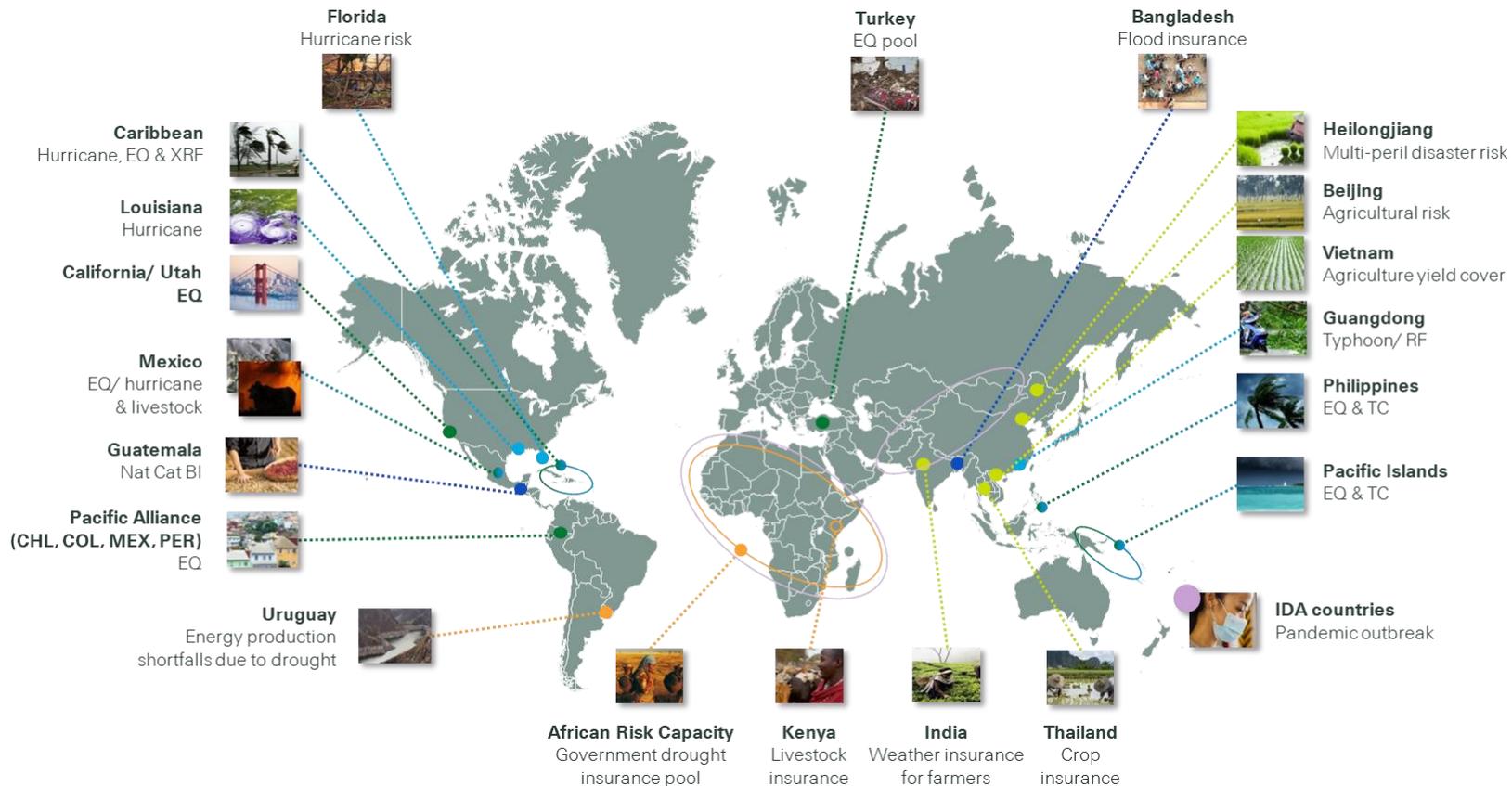
- Some RE company interviewees expressed interest in parametric insurance policies that covered periods longer than one year to reduce uncertainty about their ability to insure resource availability risks and decrease the cost.
- Three-quarters of the interviewed RE companies would consider buying a group policy to reduce the costs of parametric insurance.
- Twelve of 18 bank and insurance company interviewees were willing to consider offering, encouraging, or requiring parametric insurance for their RE clients.
- Approximately 39 percent of the bank and insurance company interviewees expressed interest in selling their clients parametric insurance from other companies on a commission basis.
- All RE industry association interviewees confirmed interest in bundling parametric insurance for their members on a fee or commission basis.



Sebabrata Sarkar

- Special Lines Innovation Senior Project Lead, Swiss Re America
- Supports global teams to develop parametric and non-parametric products for engineering and agricultural projects
- Before Swiss Re, worked with Commodity Derivative Exchanges in India
- MBA from Indian Institute of Management – Ahmedabad

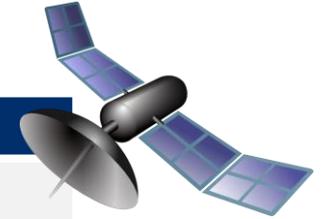
SWISS RE PARAMETRIC FOOTPRINT



SUMMARY

- Product adaptability
- Regulatory considerations
- Financial distribution
- Market awareness

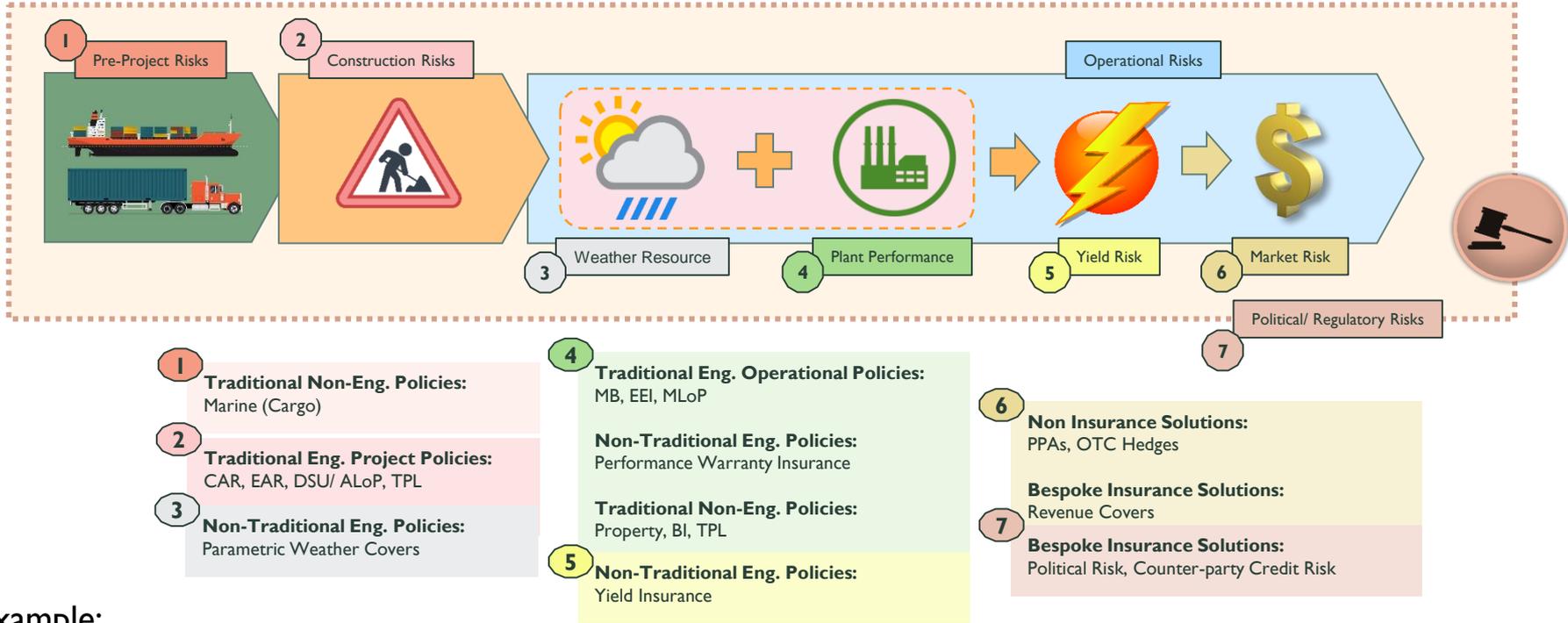
PRODUCT DESIGNS CAN BE ADAPTED BASED ON LOCAL DATA AVAILABILITY *



Item	Weather Station	Satellite/ Modelled
Basis risk	Low	Medium
Data availability	Nearby station with data for required parameter may not be available	Data available for all latitudes and longitudes, starting at grid size of $0.01^\circ \times 0.01^\circ$
Data gaps/errors	Frequent (Quality controlled data available from Licensed Data Providers)	Rare (Interpolated/modelled)
Data access	Easy to Complex (Local government permissions may be required)	Easy (Open source options available)

* Products can be offered based on actual site data as well

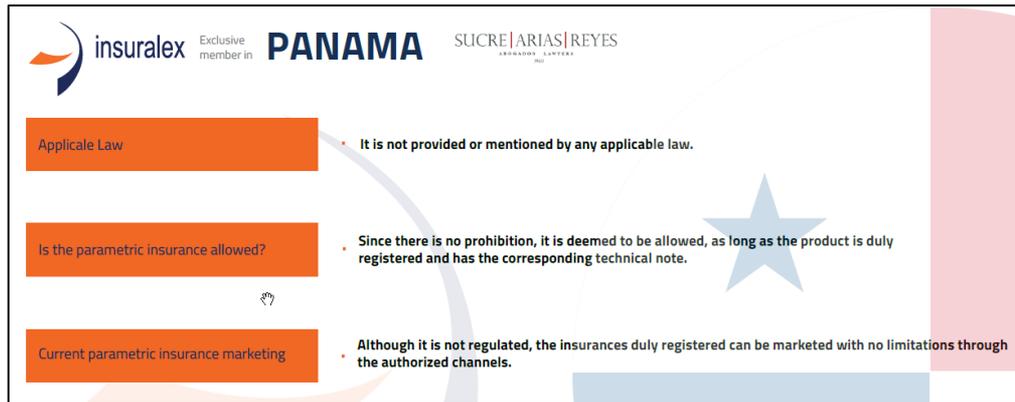
PARAMETRIC CAN BE COMBINED WITH OTHER COVERAGES TO ADDRESS LOCAL NEEDS



Example:
Solar production shortfall covers insufficient solar radiation + performance

PRODUCT DESIGN MUST CONSIDER LOCAL INSURANCE REGULATIONS

1. Is there a derivative versus insurance distinction?
2. Accounting treatment of insurance premium and claim
3. Many countries do not have clear regulations (e.g. Insuralex member study on Panama)*
4. Adding a second indemnity trigger can be considered in absence of clear guidelines*



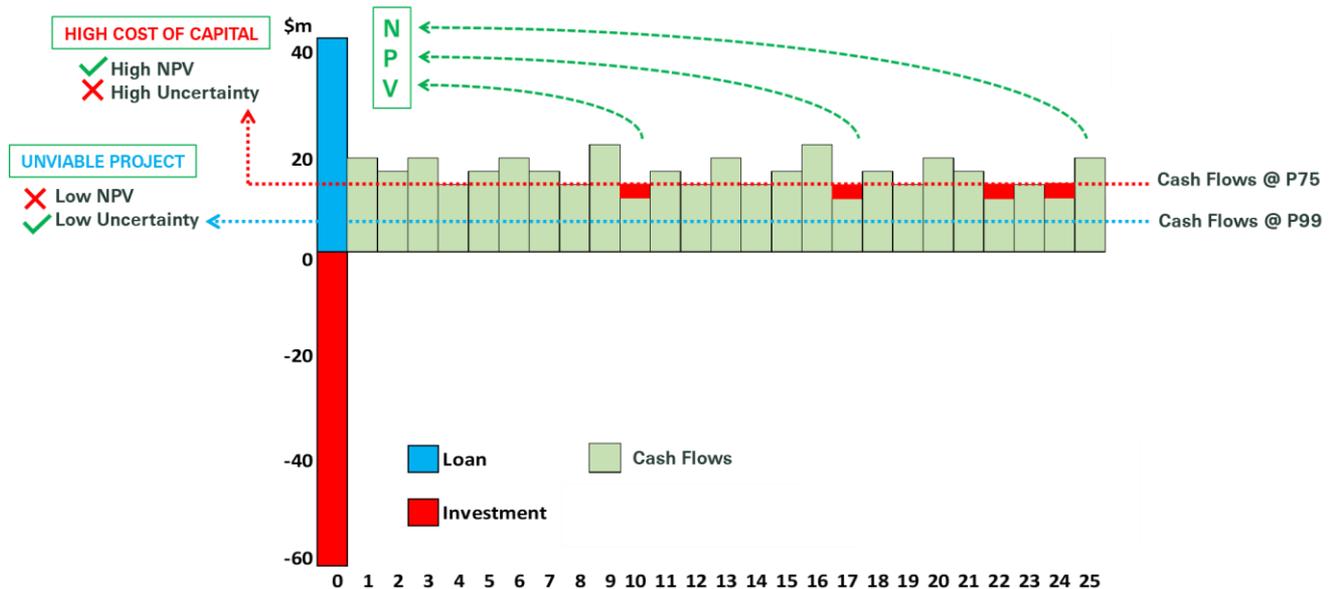
The slide features the Insuralex logo (a stylized 'i' in blue and orange) and the text 'Exclusive member in PANAMA'. To the right, it says 'SUCRE | ARIAS | REYES' with 'ABOGADOS | LEYERES' underneath. The background includes a faint map of Panama and a large blue star. Three orange boxes on the left contain questions, each followed by a red bullet point answer.

Question	Answer
Applicable Law	It is not provided or mentioned by any applicable law.
Is the parametric insurance allowed?	Since there is no prohibition, it is deemed to be allowed, as long as the product is duly registered and has the corresponding technical note.
Current parametric insurance marketing	Although it is not regulated, the insurances duly registered can be marketed with no limitations through the authorized channels.

* The information in this slide are personal opinion of the author, and Swiss Re does not accept any responsibility for its accuracy or comprehensiveness or its updating. Insurers would solely be responsible for all due diligence when it comes to regulatory approval of a new parametric product, but Swiss Re can always support insurers in these discussions.

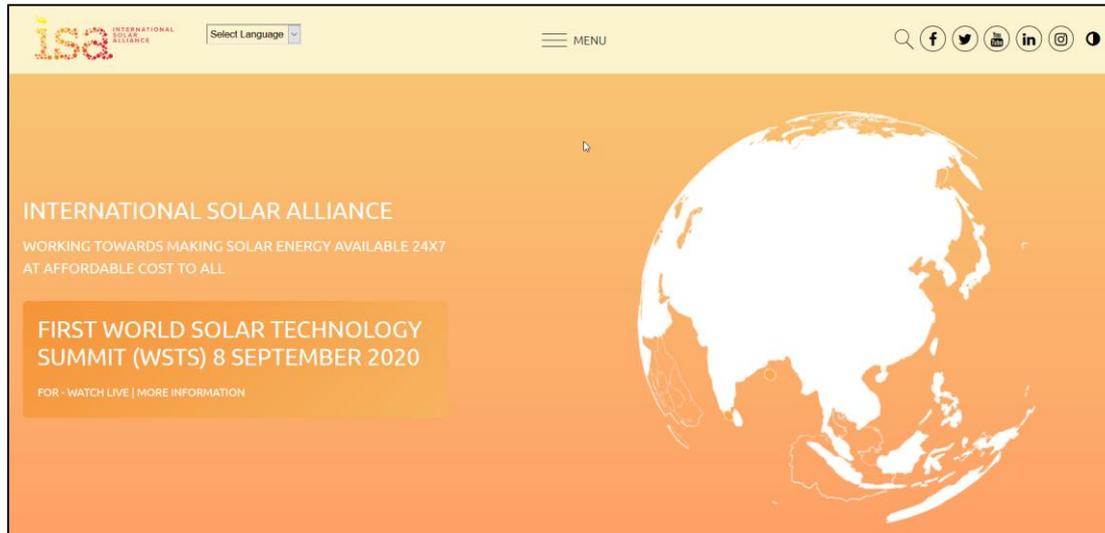
PARAMETRIC CAN IMPROVE RENEWABLE ENERGY PROJECT FINANCIAL VIABILITY

1. By reducing weather-resource uncertainty, cash flows can be projected with higher levels of confidence
2. Banks and financial institutions can be risk aggregators, reducing average cost of coverage



CREATING AWARENESS IS KEY

1. Client education needs to be driven by insurers
2. Re-insurers can support local insurers to build experience and skills
3. Policy environment needs to be favourable for insurance penetration (e.g. insurers' involvement at International Solar Alliance)



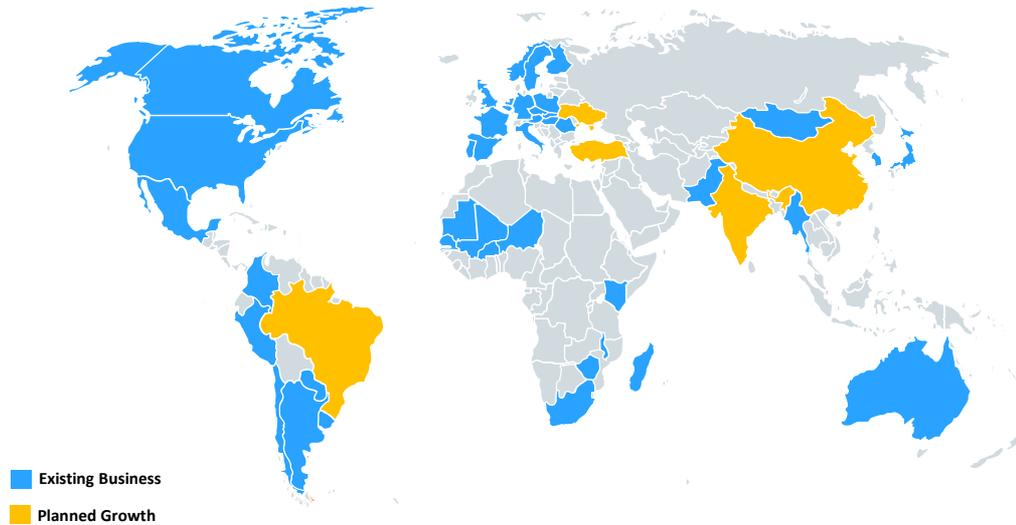


Álvaro Núñez

- Director of Origination for Latin America, Munich Re Weather and Commodity Group
- Has worked in underwriting and business development with the corporate reinsurance division in London, New York, and San Francisco
- Specialized in developing insurance solutions for renewable energy, most recently parametric solutions to mitigate losses from non-catastrophic weather events

MUNICH RETRADING LLC (MRTL) OVERVIEW

Transaction Geography



- Part of the Weather and Commodity group within the Capital Partners Division.
- Two hubs, Houston and Zurich, cover our global operations

MTRL BUSINESS APPROACH

- Provide risk management products to corporate clients worldwide
 - Allow clients to mitigate economic losses associated with non-catastrophic weather events (e.g., excess/insufficient temperatures, precipitation, and/or wind)
 - Typically structured as derivative contracts but can be structured as insurance contracts
 - Derivative is a contract of differences, with mathematical objectivity, designed to absorb an exact portion of exposure. It is not an indemnity contract as an insurance contract, so there is no need to prove a loss. Derivatives follow a generic framework put in place by the ISDA, but it is regulated by local authorities. The ability to transact depends on local derivative laws.
- Business in virtually all sectors directly/indirectly exposed to weather
 - Energy industry is exposed to weather on demand and supply side
 - Construction industry suffers in cold winters and rain
 - Tourism industry suffers from lack-of-snow, lack-of-sun and rain
 - Agroindustry suffers from weather-induced yield shortfalls (e.g., droughts)

BASED ON RISK CLASS, TWO MAIN PRODUCT TYPES

- Weather risk management products
 - Pay counterparty if realized weather falls outside established range
 - Can be based on related temperatures, precipitation, solar irradiation or wind
 - Counterparty could also face demand risk from mild winter/cool summers
- Weather-contingent commodity products
 - Combining volumetric risk and price risk
 - Benefit counterparty if both realized weather and price of related commodity fall outside established range
 - Available in Australia, European Union, Japan and United States

OPERATIVE WEATHER INDEX

- Cumulative Temperature:
 - Heating Degree Days (HDD) in winter
 - Cooling Degree Days (CDD) in summer
 - Composite Weather Variable (CWV) incl. wind chill
 - Frost days
 - Cumulative average temperatures
- Lack-of-Wind:
 - Cumulative wind
 - Cumulative modeled wind power generation
- Precipitation and streamflow:
 - Cumulative precipitation
 - Cumulative rain days
 - Reservoir level
- Lack-of-Sun:
 - Global radiation
 - Sunshine duration

WEATHER RISK MANAGEMENT: STRUCTURE EXAMPLES

- Options (*puts* and *calls*), *swaps*, *caps*, *floors*, and *collars* are common derivative structures
 - Puts are common structure for insurance parametric contracts
- Example of a put structure
 - Hedging structure could be with respect to rainfall exposure
 - Counterparty could be hydroelectric generator willing to hedge financial impact of low precipitation and low streamflow
 - Put structure will provide a floor on amount of average rainfall (mm) or river streamflow
 - Weather and Commodity group will pay out if rainfall or streamflow drops below certain level
- Contracts are indexed to publicly available weather data
- Contracts are typically “seasonal”
 - Terms of up to 12 months
 - Preferable term is 1-3 years
 - 3-5 year term available for weather-indexed structures

MTRL IN LATIN AMERICA

- In Latin America since early 2010s
- Energy and agriculture industries core to strategy
 - energy industry focuses on hydroelectric, wind, and solar generation
- Also engages with construction, municipalities, exploration and mining
- Weather transactions in Latin America, including Chile and Colombia
- Current pipeline includes Brazil, Guatemala, Mexico, Peru, and Uruguay

MTRL IN LATIN AMERICA

- Weather and Commodities group can structure solutions as derivative contracts or as parametric re-insurance contracts
- Munich Re issues reinsurance licenses across the region to cover non-catastrophic weather events
 - With support of subsidiary New Reinsurance Company Ltd. (NewRe),
- Building business ecosystem with power generators, energy distributors, energy traders, (re)insurance brokers, insurance companies, financial institutions, and consulting companies

QUESTIONS AND ANSWERS



**Santiago Enriquez,
CEADIR**



**Sebabrata Sarkar,
Swiss Re**



**Álvaro Núñez,
Munich Re**

FOLLOW UP

- Webinar recording and presentation will be shared with all registrants
- Report available at <https://www.climatelinks.org/resources/parametric-insurance-renewable-electric-power-producers-central-america>
- Access previous CEADIR discussions and resources on our [Climatelinks Resource Page](#).
- Additional questions?
 - Pablo Torres: ptorres@crownagents.com
 - Santiago Enriquez: Santiago_Enriquez@abtassoc.com
 - Álvaro Núñez: Alvaro.Nunez@mrtl.com
 - Sebabrata Sarkar: Sebabrata_Sarkar@swissre.com