



Swiss Re
Corporate Solutions

Global Resilience Risk An Insurers Perspective

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Swiss Re Weather Market Capability

Global presence, market leadership

Swiss Re Group

- Leading reinsurer and direct insurer
- Over 11,000 employees
- Global presence with 48 offices in over 20 countries

Americas

New York, Houston

EMEA / Asia-Pacific

Zurich, London

Long-standing experience

- Weather protection business established in 1999
- Continuous involvement in weather risk management since then

Global team

- A global team of more than 30 weather professionals
- Execution capabilities in all geographies

Market leadership

- Largest weather protection provider in the world
- Track record of product innovation
- Only full-service insurer with market leading position
- **More than USD 1 bn of weather risk assumed in 2012**

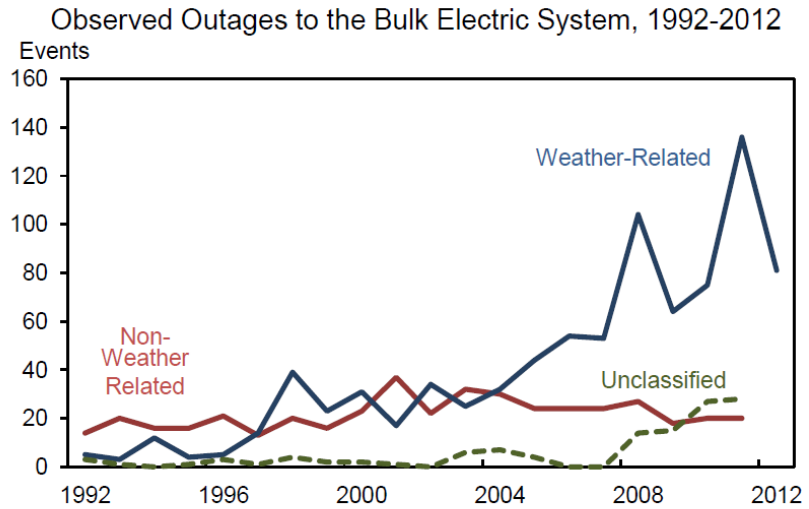
■ Swiss Re Offices ● Weather Professionals

Introduction

- Resiliency risk is growing being driven by climate change, emerging energy technologies and extreme weather events.
- There are very clear extreme weather trends which are magnifying resiliency risks.
- Traditional and parametric insurances provide financial and operational restoration resilience.
- Extreme to normal weather impacts the energy supply chain in a number of ways.
- Weather resilience risk is exacerbated by rapidly increasing renewable penetration into traditional grids:
 - Production / earnings variability;
 - Grid capability to support renewable penetration?
- Parametric solutions are available to hedge uncertain production volume and extreme weather events.

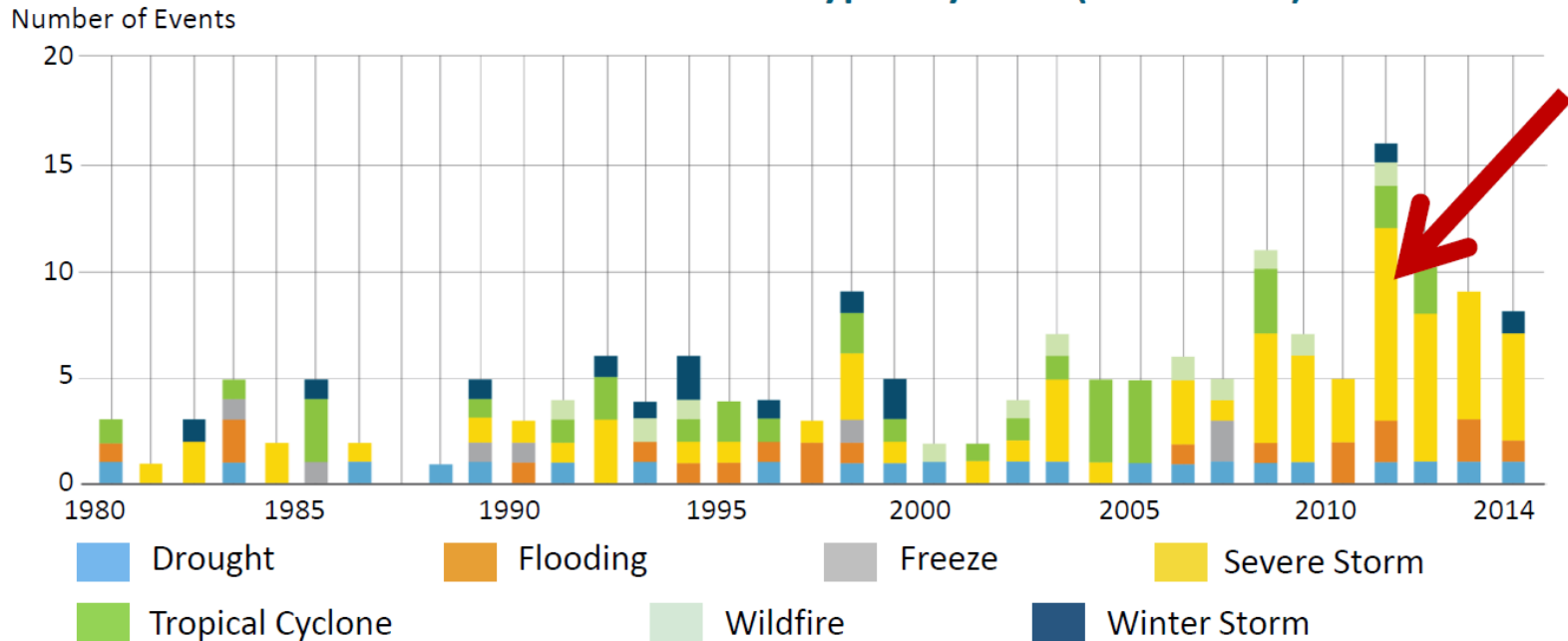
USA Trends of Severe Weather Disruptions

- Whether you believe in climate change or not extreme weather events are increasing!



Source: Energy Information Administration

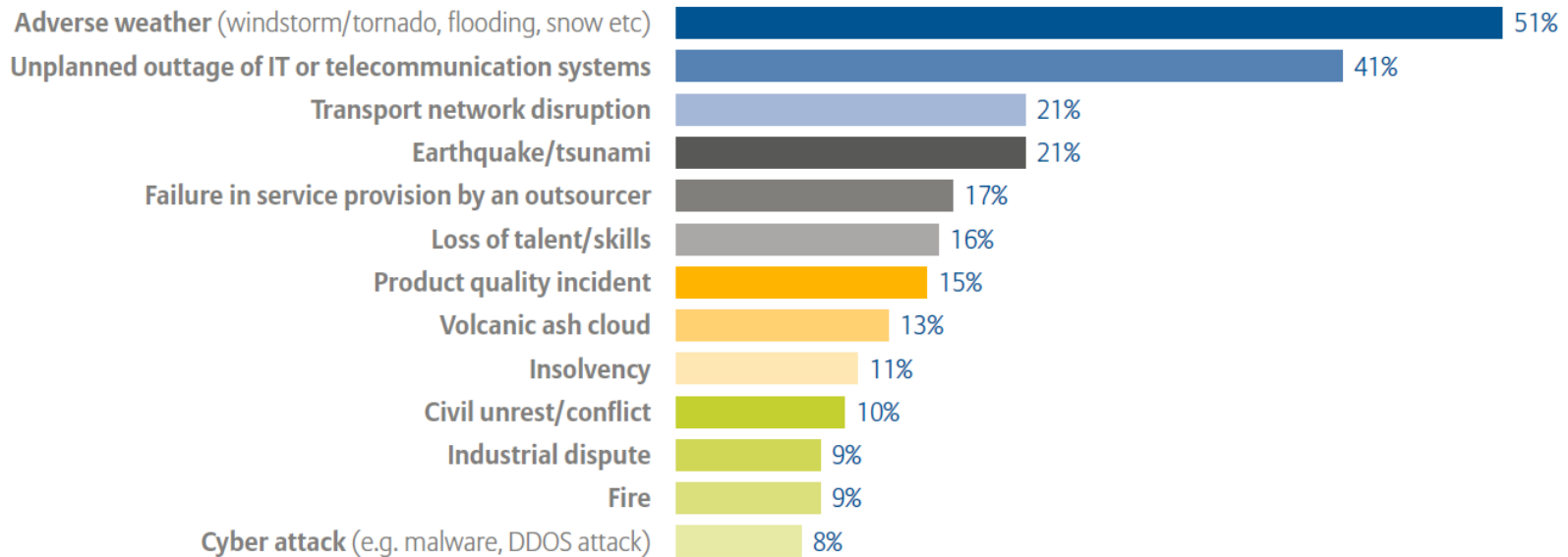
Billion-Dollar Disaster Event Types by Year (1980-2014)



The Supply Chain Threats: Weather Dominates!

Major sources of supply chain disruptions

Percentage of firms suffering disruption caused by listed incidents



Source: Supply Chain Resilience 2011, The Business Continuity Institute

Traditional vs. Parametric Cover

- **Traditional Insurance products are indemnity based:**

- Repair / replacement of damaged asset being indemnification for consequential loss incurred;
- Economic loss / BI (Business Interruption) only covered as a direct consequence of physical damage to the property insured.

- **Parametric covers are index or production based:**

- Cover is triggered if pre-defined event parameters are met or exceeded;
- Payout of specified amount, regardless of actual financial loss sustained.



- **Alternative to complement traditional insurance programs for pure economic losses or "uninsurable" perils;**
- **Triggers before BI cuts in when the financial and supply risk is greatest.**



Understand Insurance?

Then you understand parametric derivatives

Options/derivatives/protection	Insurance
Weather or Index trigger level	Peril covered
Strike level (eg: Spot price to PPA level)	Attachment point / retention
Payoff - formulaic	Claim
Tick value – fixed dollars per unit	Size of loss
Premium	Premium
Limit – of protection eg maximum value or event days	Limit

Parametric Solutions: Basics

WHEN?

Parametric products apply:

- Traditional capacity is:
 - Not available for non-insurable risk outside BI or CBI;
 - To fill the business interruption time delay gap;
 - Scarce i.e. after earthquake or hurricane events;
 - When recovery and fast payment is sought.

WHY?

- Potential accumulation exposure, hence heavily sub-limited;
- Lack of transparency (unspecified suppliers / customers);
- Unavailability of material facts;
- Demanding contingency planning analysis;
- Pricing difficulties;
- Coverage uncertainties.

WHAT?

Cover relying on the measurement of a natural phenomenon or index:

- Event / weather indices: EQ magnitude, temperature, wind speed, precipitation, etc;
- Can be in combination with indices or commodity prices: CPI, gas, electricity etc;
 - Rainfall converting to power price.

Weather Related Energy Market Risks

- Weather drives energy output and therefore revenue year to year:
 - Wind can vary 15% to 20%;
 - Solar can vary 5%.
- PPA's only hedge price and not volume:
 - Underproduction means not being paid for the black and the green components.
- There are innovative ways to hedge volume risk to compliment a PPA or merchant exposure.
- Swiss Re have written bespoke parametric derivative hedges for:

Renewables

- Low wind;
- Low irradiation;
- Low rainfall.

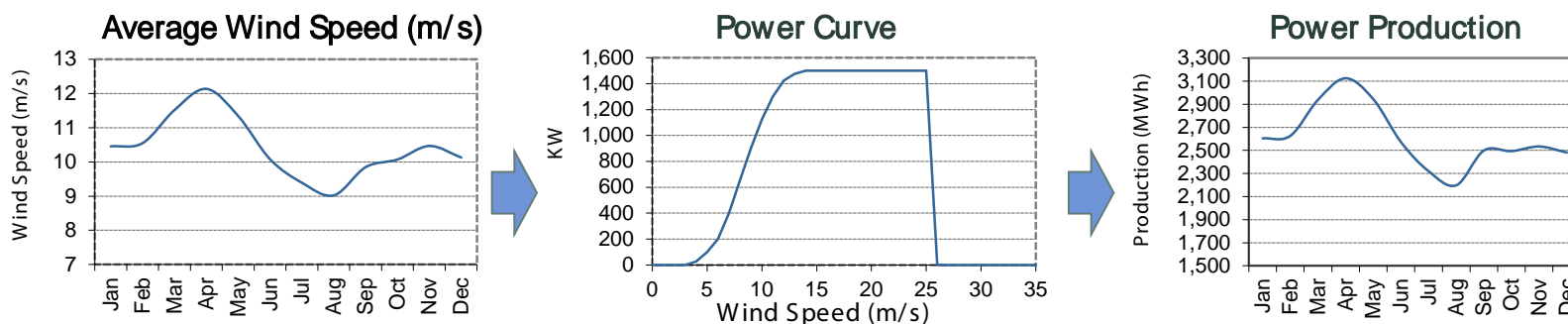
Thermals

- High wind;
- High irradiation;
- High rainfall.

Case Study Weather Risk – Lack of Wind

Protection based on modelled or metered power production

- The power production of a wind farm naturally depends on wind speed. The relationship is described below (for a given turbine):



- Depending on the availability of historical production information, power production levels can be hedged on the basis of:
 - i) Measured wind speeds (m/s);
 - ii) Metered physical production of power (MWh's);
 - iii) A portfolio of wind farms at various locations.

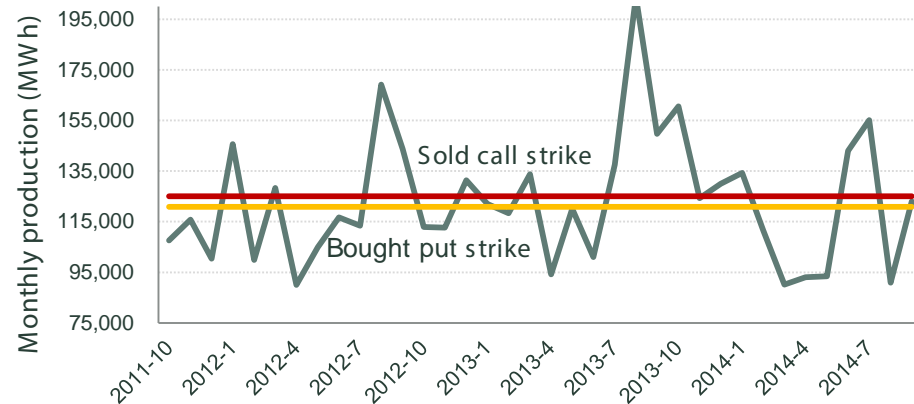
Weather Risk – Wind

Recent example: multi-location portfolio MWh hedge

Six wind farms in WA, SA and NSW > 500MW's

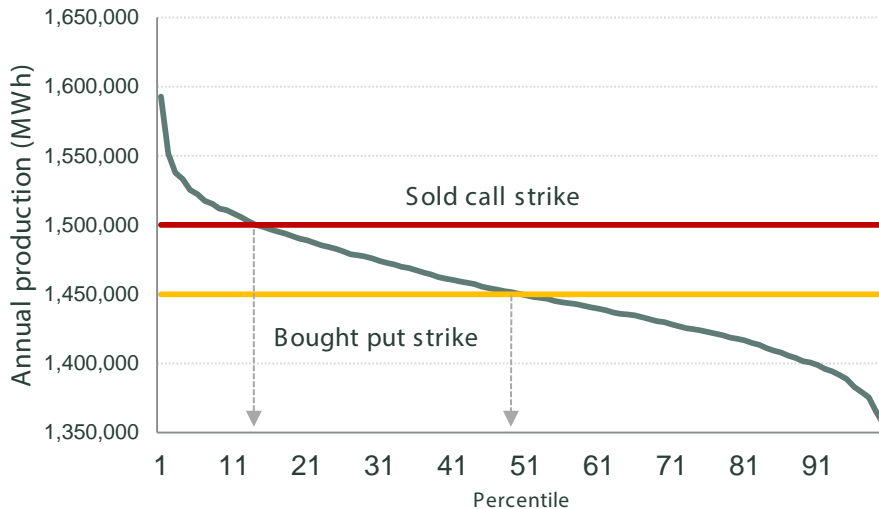
Key points of difference:

- Actual energy production, not wind speed;
- Incorporates availability scaling which eliminates Swiss Re exposure to "man made" risk and the client being over hedged due to outages;
- Fixed \$'s per MWh worst case tick value inclusive of green certificates.



Production is highly seasonally variable

Expected revenue from power production



Percentile	Production (MWh)	Gross Revenue (\$m)	Payout (\$m)	Net Revenue (\$m)
1	1,592,910	135.40	-5.00	130.40
10	1,510,834	128.42	-0.92	127.50
20	1,490,142	126.66	0.00	126.66
30	1,475,863	125.45	0.00	125.45
40	1,461,199	124.20	0.00	124.20
50	1,450,282	123.27	0.00	123.27
60	1,440,517	122.44	0.81	123.25
70	1,429,696	121.52	1.73	123.25
80	1,417,660	120.50	2.75	123.25
90	1,400,542	119.05	4.20	123.25
100	1,356,390	115.29	5.00	120.29

Wind Farm Portfolio - Term Sheet

Most of the deal criteria below are market leading world firsts

Insured	Windfarm portfolio owner
Risk taker	Swiss Re
Covered peril	Insufficient annual wind resource measured in MWh's for expected output range
Location	WA, SA and NSW (multi-locational spot prices)
Capacity	>500MW's
Term	1 year
Collar strikes	Call @ 1,500MWh's and Put @ 1,450MWh's
Wind production hedge	Output on an agreed MWh collar for six windfarms in three states
Tick value or notional	\$85MWh (represents black and green energy component prices)
Annual payout	(Strikes + or – MWh's) x AUD \$85 per MWh
Premium	Equated to less than 1% of revenue
Special payout condition	Turbine availability scaling mechanism to protect the client against outages and Swiss Re against "man made" risks
Deal limit	Capped at minimum and maximum client expected earnings range

Electricity Price and Outage Risk (ELPRO)

Cover for power plant outage and price risk

Product overview

Covers thermal generators for supply chain disruption (forced outages and de-rates) for volume and price risk:

- Protecting operators against their contractual obligations;
- Sits between day zero and business interruption.

Target clients

- Gen-tailers and generators with operational and contractual risk exposure caused by unforeseen physical events;
- Energy traders wishing to mitigate firm contract risk against spot outcomes by targeting ELPRO on system generators;
- Retailers wishing to mitigate load risk against spot outcomes by targeting ELPRO on system generators;
- Applies regardless of how regulated or unregulated the energy market is.

Value proposition

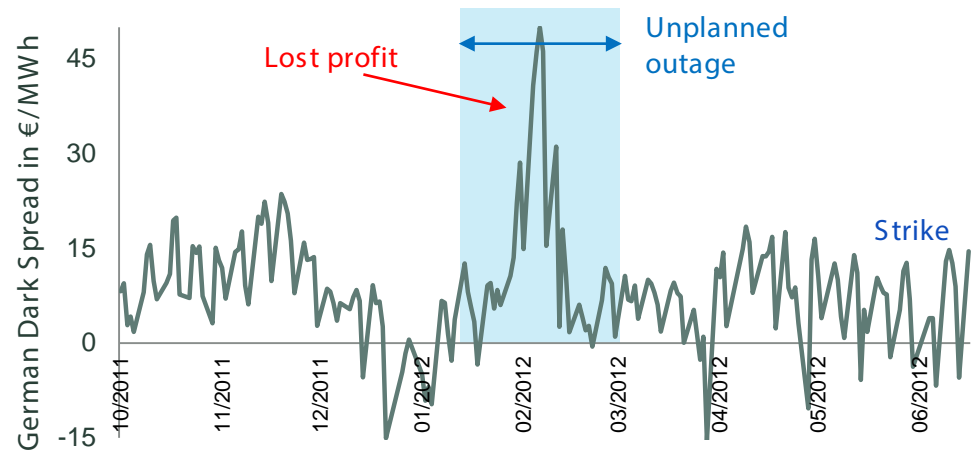
- Can be totally customized for individual or an entire fleet of thermal plants;
- Allows customer to fully contract output in order to optimize earnings eliminating N-1 or N-2 contingency;
- Generally significantly discounted to standard capacity hedges eg caps;
- Avoids exposure to the potential for very expensive short term hedges;
- Formulaic settlement means minimal claims process and quick payment for losses.

Electricity Price and Outage Risk (ELPRO)

- Upon a forced outage, power producers face two hard to hedge simultaneous risks:
 - Volume risk;
 - Price risk.
- ELPRO increases financial resilience, especially when the power plants have become less reliable.
- Pays out when one (or several) power plants experience a de-rate or forced outage when defined threshold is exceeded.
- In essence, ELPRO provides financial resilience.
- Covers a plant impacted by extreme weather.

Example: German dark spreads

(electricity price – cost of power production with coal – CO₂ charge)



Electricity Price and Outage Risk (ELPRO)

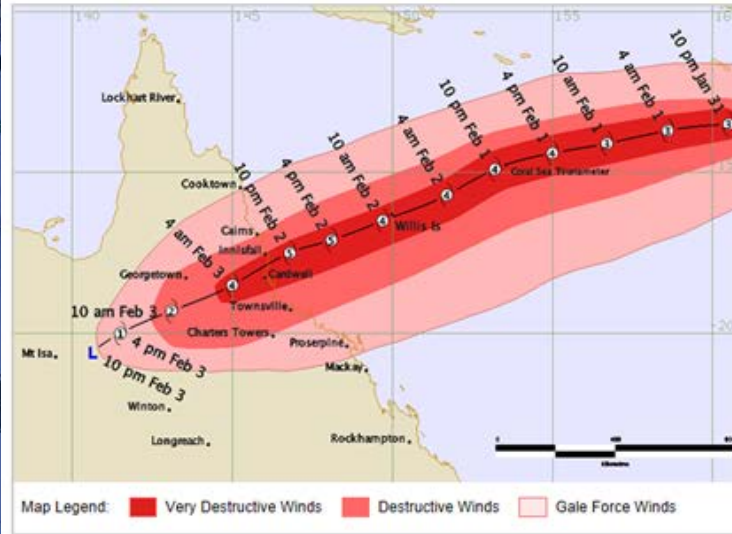
Term Sheet: Australian Generation Portfolio

Counterparty	Australian Gen-tailer: Thermal Fleet approx. 4'500 MW
Qualifying Events	Outage and derating
Event Duration Cap	28 Calendar Days
Event Deductible:	AUD 6,500,000 (Can be time based)
Determination Period:	January 1, 2014 – December 31, 2015
Hours Covered	NEM Peak Hours (7.00 to 22.00) or working week days
Settlement Index:	NSW and VIC RRP
Strike Price:	\$300 MWh cap
Payout Function	$((\text{Settlement Index} - \text{Strike Price}) * (\text{Event Duration} * \text{Notional Quantity})) - \text{Event Deductible}$
Payout Limit	AUD 40,500,000 for term
Term Premium	AUD 3-4m
Notional Quantity	500 MW's
Share of Program	100%



A similar protection is feasible for nearly any type of power plant

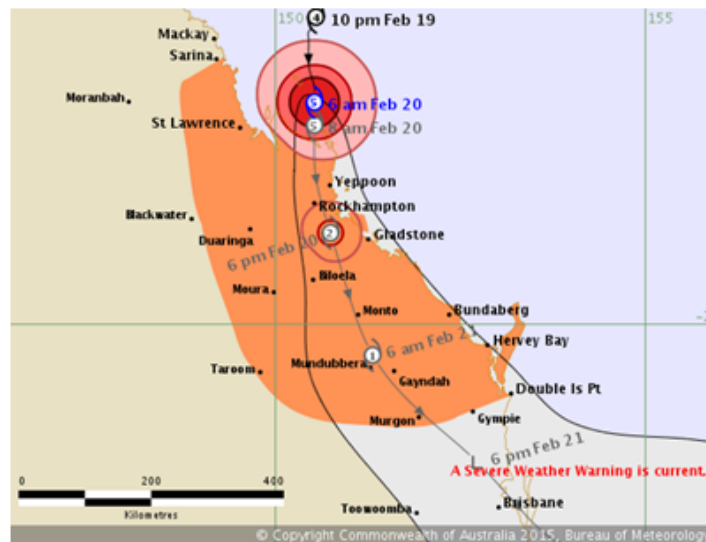
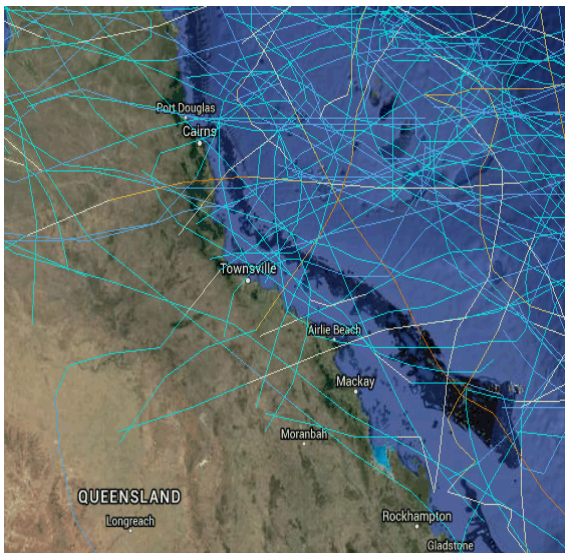
Extreme Weather – Australian Network Example



Conditions	Measures	Condition met?
Max. Wind Gust	> 279 km/h	✓
Location	Box Crossed	✓

➤ Payout of AUD 50 m under suggested structure

Cyclone Marcia 2015



Conditions	Measures	Condition met?
Max. Wind Gust	> 279 km/h	✓
Location	Box Missed	✗

➤ No payout (eligible event outside of the box)

Cyclone Yasi 2011

Conclusion

- Physical damage does not matter for recovery under the parametric cover:
 - Payments can be used to cover a broader scope of losses;
 - Non-damage BI, Contingent BI, Extra Expense, and other losses typically excluded (“non-insurable assets”) or heavily sub limited in traditional insurance cover;
 - Products like ELPRO and weather derivatives are available to fill the BI gap.
- **Weather phenomena earnings volatility and impacts can be hedged.**
- Customized solutions offer protection against all supply chain weather and outage risks by converting to a hedge for the underlying commodity price triggered by things like:
 - Extreme weather;
 - Low or high irradiation (sunshine);
 - Low or high rainfall;
 - Low or high wind
 - Physical outages and de-rates.

Thank you

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