

## WRMA 2007 Asian Committee Meeting

# Exploring New Frontiers - Beyond Standard Degree Day Contracts

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Merrill Lynch Commodities

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## Agenda

- **Standard Weather Indices**
- **Precipitation-Based Contracts**
- **Wind Risk Management Instruments**
- **Weather & Commodity-Linked Products**
- **Outlook**



# Merrill Lynch Global Commodities

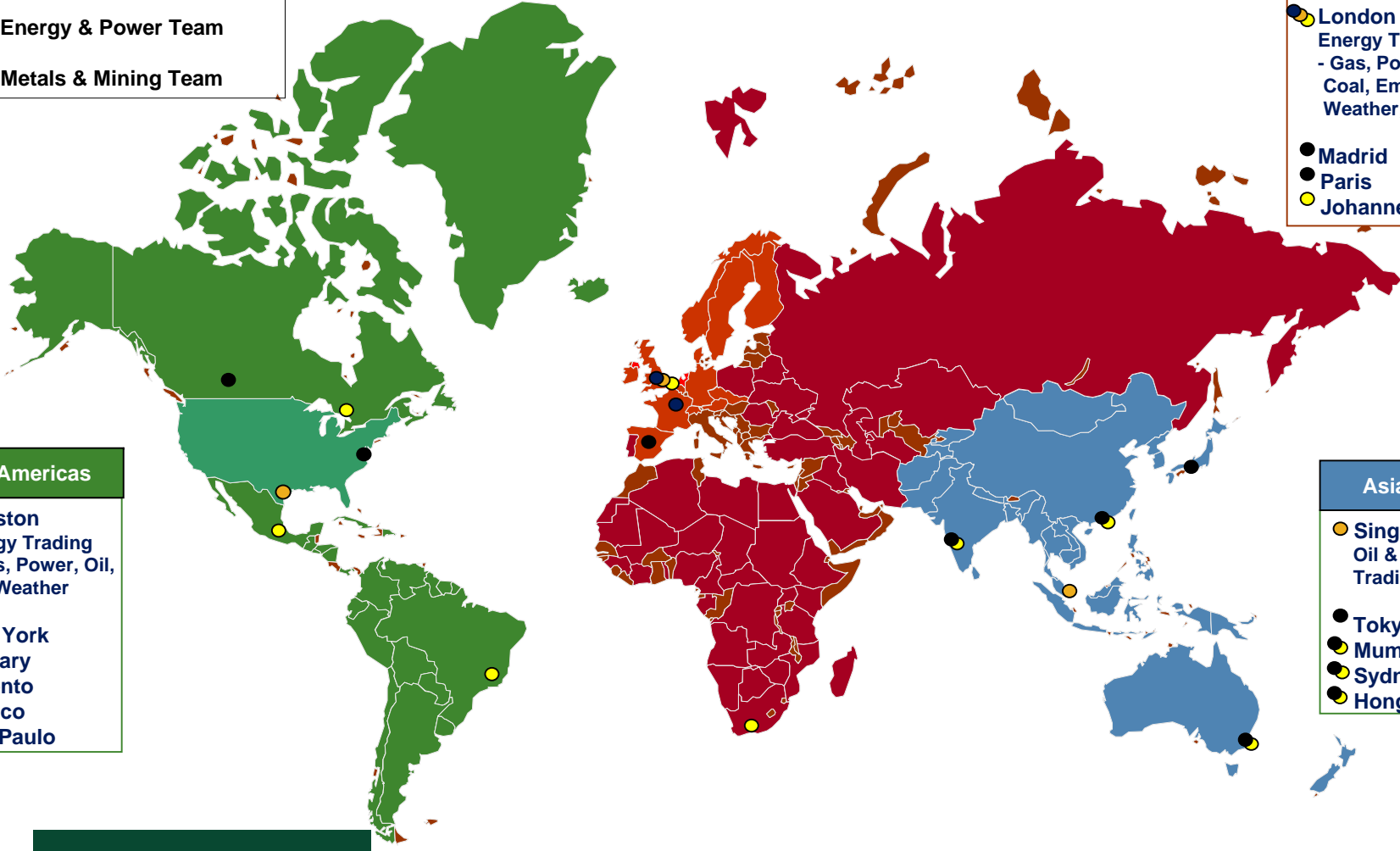
## Global Presence

- Commodities Trading Platform
- IBK, Energy & Power Team
- IBK, Metals & Mining Team

- Europe & Africa**
- London  
Energy Trading  
- Gas, Power, Oil,  
Coal, Emissions,  
Weather, Metals
  - Madrid
  - Paris
  - Johannesburg

- The Americas**
- Houston  
Energy Trading  
- Gas, Power, Oil,  
Coal, Weather
  - New York
  - Calgary
  - Toronto
  - Mexico
  - Sao Paulo

- Asia Pacific**
- Singapore  
Oil & Products  
Trading
  - Tokyo
  - Mumbai
  - Sydney
  - Hong Kong



## MLGC's Weather Desk

- Merrill Lynch Global Commodities' (MLGC) weather group is a leading dealer of weather derivatives and provider of weather risk management solutions
- MLGC conducted the first ever weather trade in September 1997 (as Koch Industries) and is the only company with a continuous presence in the weather market since its establishment
- Global market coverage: weather desks at offices in Houston (USA/ Americas) and London (Europe, Africa, Asia, Australia) are involved in approximately 20% of all global weather transactions



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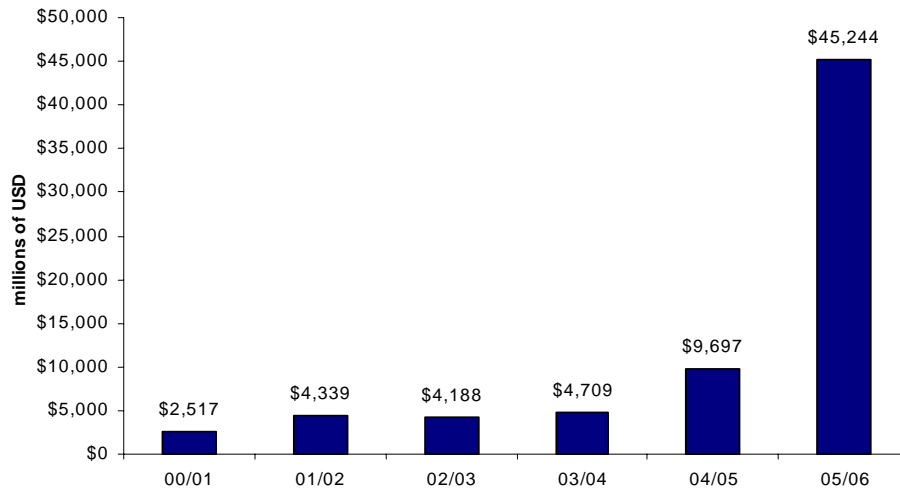
## Example Weather Indices

- Temperature
  - HDD – Heating Degree Day, e.g.  $\max(18^{\circ}\text{C} - T_{\text{avg}}, 0)$
  - CDD – Cooling Degree Day, e.g.  $\max(T_{\text{avg}} - 18^{\circ}\text{C}, 0)$
  - $T_{\text{max}}$ ,  $T_{\text{min}}$ ,  $T_{\text{avg}}$
- Precipitation
  - Sum of rainfall in mm over specified period
  - Snow height in mm
- Wind speed
  - MLGC Wind Power Index ( $\text{WPI}^{\text{TM}}$ )
  - Customised index based on local wind speed measurements
- Critical Day contracts, based on indices above

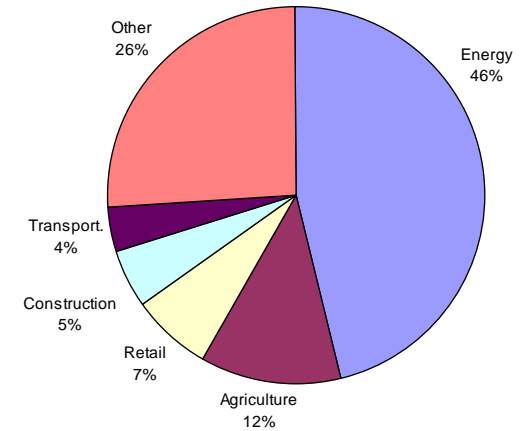


## Weather Derivatives Global Market Size and Structure

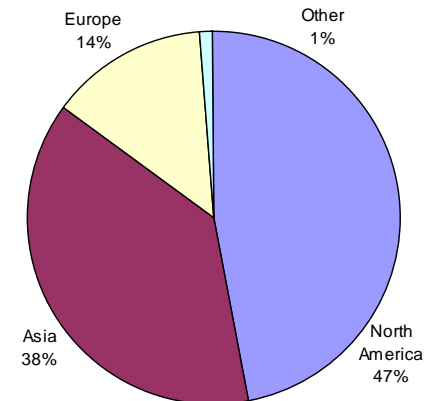
### Weather Derivatives Market Notional Value<sup>(1)</sup>



### End-User Inquiries<sup>(1)</sup>



### Number of Contracts by Region<sup>(1)</sup>



Despite continuous regional and end-user diversification, the vast majority of market growth can be attributed to degree day contracts.

<sup>(1)</sup> Source: PWC/WRMA industry surveys



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## Example: Precipitation-Based Contracts (1)

- Dependence of Spanish Power Generation on Precipitation

"Total capacity in Spain amounts to 45GW. Hydroelectric capacity accounts for 34% of the total, followed by 26% coal-fired, 19% oil and gas and 18% nuclear.

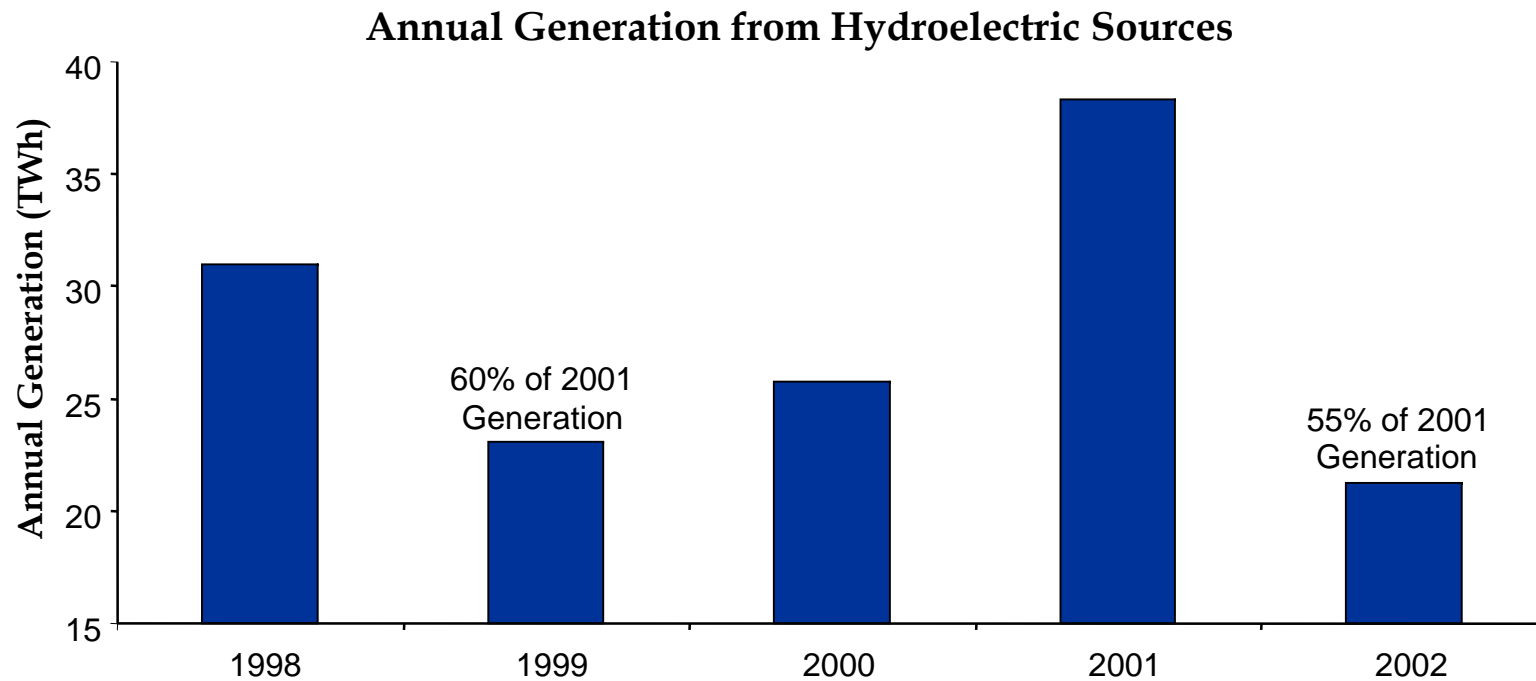
The hydro generation is 65% run-of-river and 35% reservoir. A highly variable rainfall makes the fuel generation mix difficult to predict from year to year. For example, drought in early 1999 meant that hydro generation accounted for only 13% of generation in 1999."

*Source: Platt's*



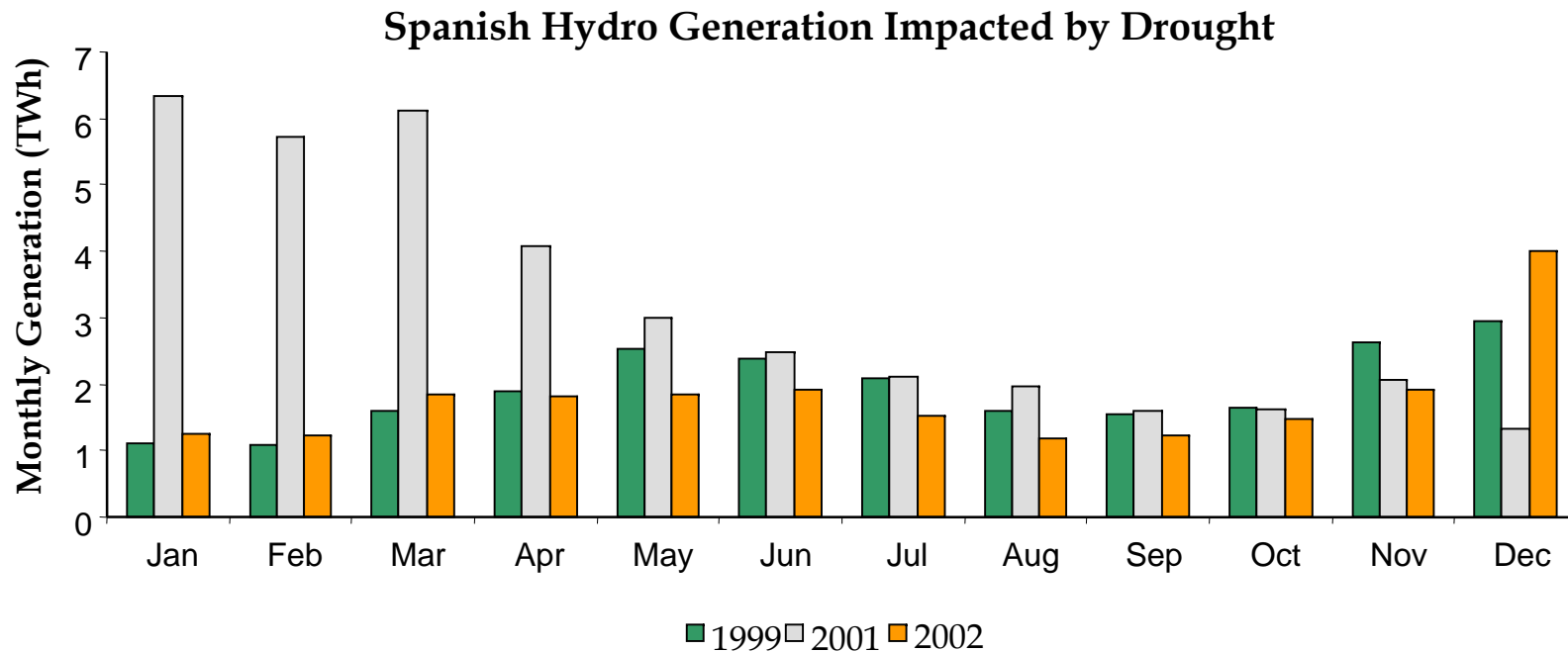
## Example: Precipitation-Based Contracts (2)

- Precipitation Risk Impacts Hydro-Electric Generation by Typically  $\pm 30\%$



## Example: Precipitation-Based Contracts (3)

- Drought Years (1999 & 2002) Had Large Shortfalls in Generation in Jan-Apr



Source: MLGC analysis, OMEL website

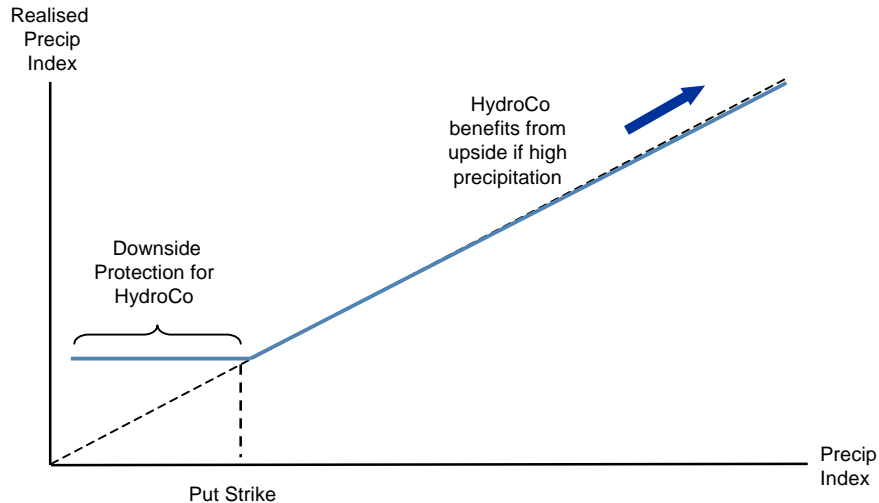
## Precipitation-Based Contracts: Sample Term Sheet

### Hedging Strategy: Put Option

Under this agreement, the seller pays the buyer if the defined weather index falls below the put strike.

The payment case is equal to the number of units the weather index falls below the strike times the tick size, up to the maximum payout limit.

The buyer pays an upfront premium.



### Indicative Terms and Conditions

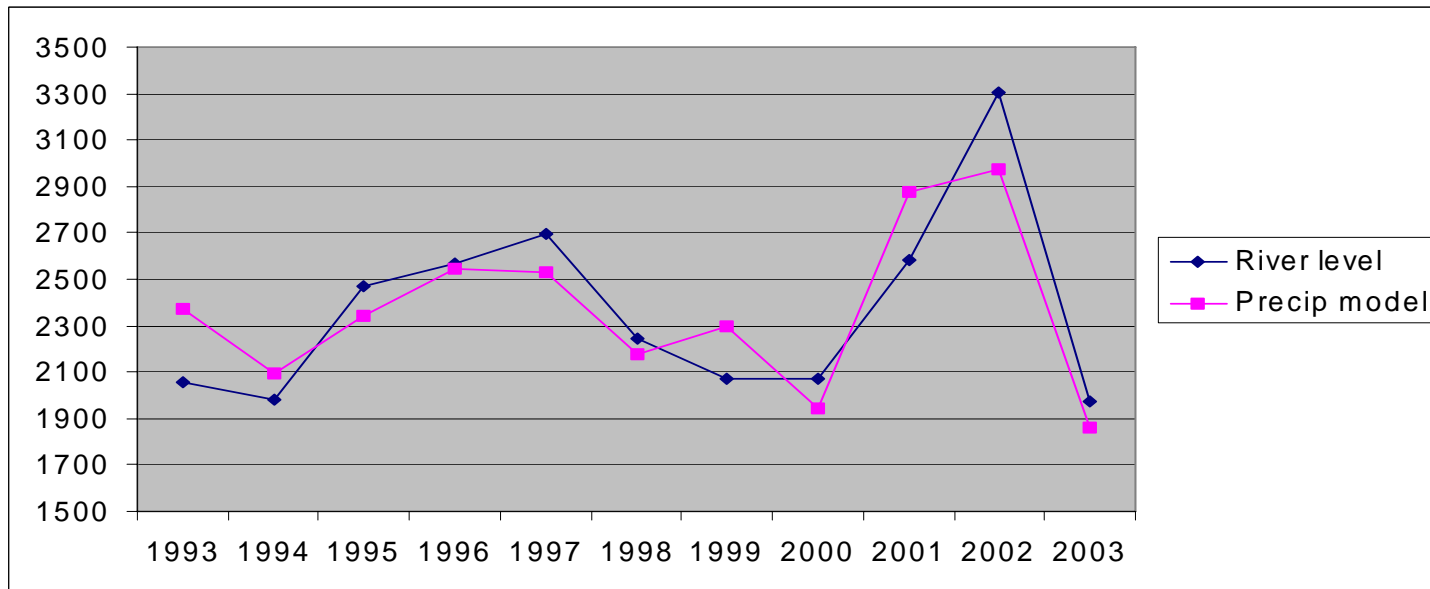
<b>Instrument:</b>	Put Option
<b>Station:</b>	[Basket of Stations...]
<b>Trade Underlying Index:</b>	Sum of Precip
<b>Buyer:</b>	HydroCo.
<b>Seller:</b>	Merrill Lynch
<b>Tenor:</b>	01-Jan-2007 to 31-Apr-2007
<b>Put Strike:</b>	180 mm
<b>Tick Size:</b>	100,000 EUR
<b>Payout Limit:</b>	10,000,000 EUR
<b>Premium:</b>	1,500,000 EUR
<b>Index Statistics:</b>	
20-Year-Average:	210 mm
Minimum (2003):	85 mm
Maximum (1989):	427 mm



## Innovative Models Could Complement Standard Indices

- Alternative indices (e.g. Stream Flow Index, Agricultural Yield Index) indices might meet companies' needs better than outright weather measurements

Example of Czech river level model



- If no sufficient historic data is available, those indices could be modelled based on precipitation



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# WIND POWER INSTALLED IN EUROPE BY END OF 2005 (CUMULATIVE)

EU – 40,504 MW

ACCESSION COUNTRIES – 28 MW

EFTA COUNTRIES – 279 MW

Iceland  
0

Faroe Islands  
4

Rep. Of Ireland  
495.5

UK  
1,353

Netherlands  
1,219

Belgium  
167

Luxembourg  
35

France  
757

Switzerland  
11.6

Portugal  
1,022

Spain  
10,027

Italy  
1,717

Malta  
0

Norway  
267

Sweden  
500

Finland  
82

Denmark  
3,122

Estonia  
30

Latvia  
26

Lithuania  
7

Poland  
73

Germany  
18,428

Czech Republic  
26

Ukraine  
82

Slovakia  
5

Austria  
819

Hungary  
17

Romania  
1.4

Slovenia  
0

Croatia  
6

Bulgaria  
1

Turkey  
20

Greece  
573

Cyprus  
0

Source: EWEA ([www.ewea.org](http://www.ewea.org))



**EWEA**  
THE EUROPEAN WIND ENERGY ASSOCIATION

## What is Wind Risk?



- Wind risk is defined as the risk of lower than expected wind speeds and hence generation, resulting in lower revenues

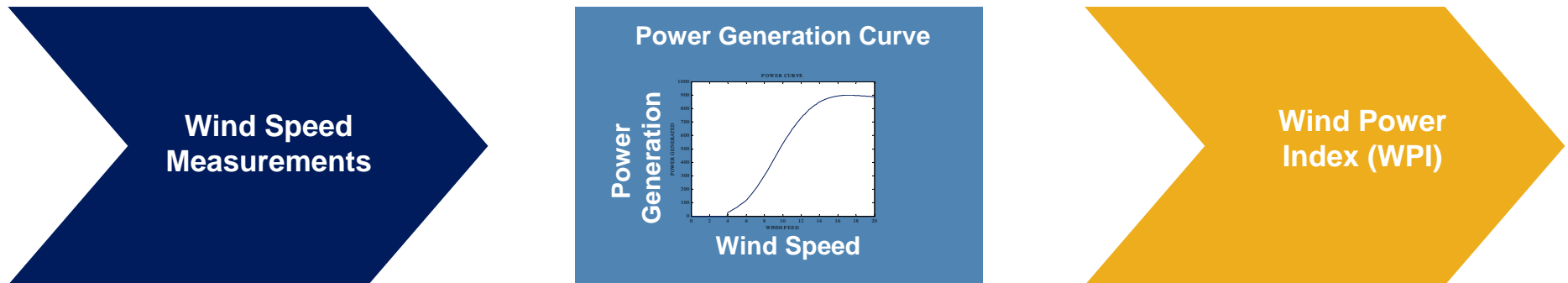


## Creation of an Underlying Weather Index: Wind Power Index (WPI)

- WPIs are purely based on wind speed measurements from independent sources
- Translation of wind speed into theoretical generation output

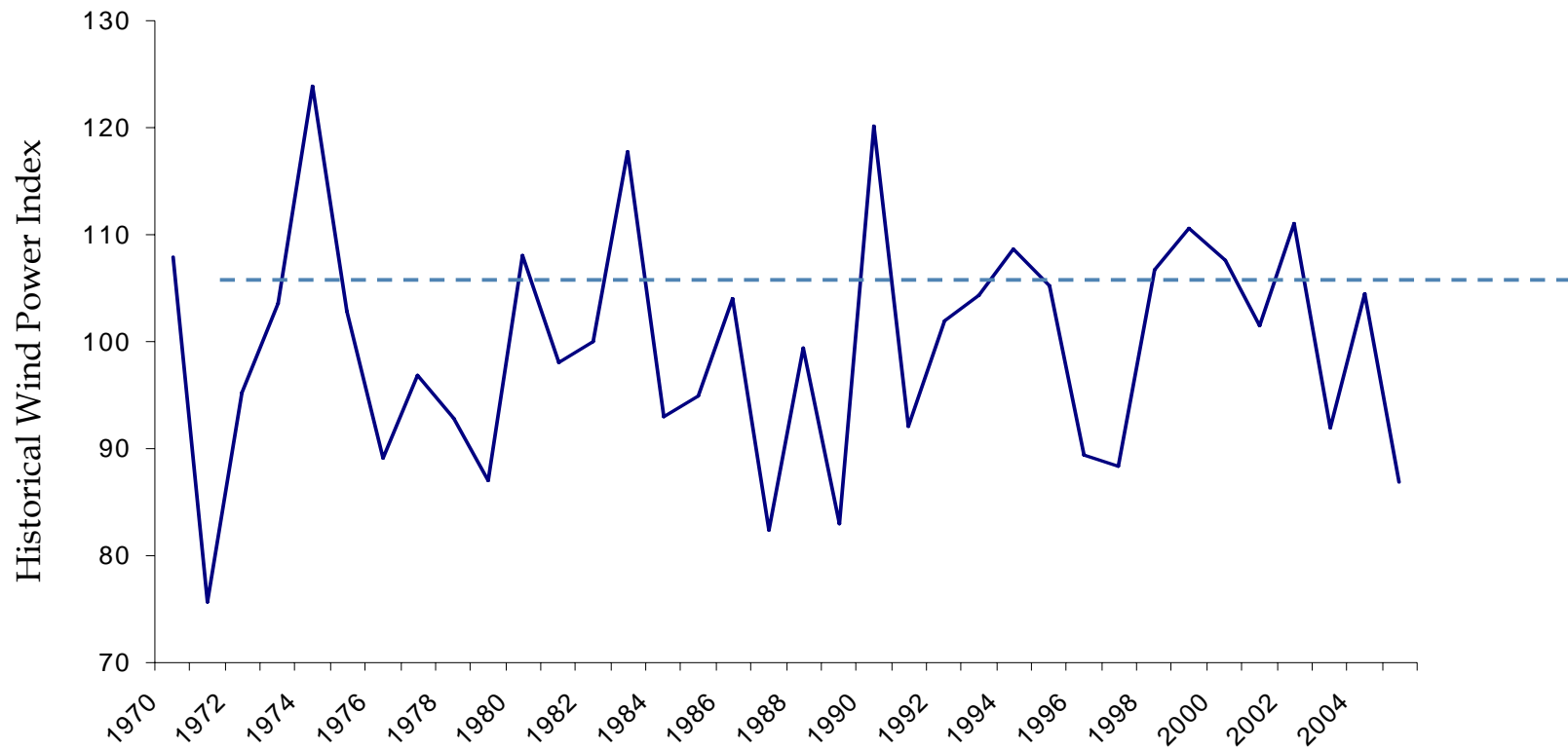
### Input requirements to create a customised WPI:

- Location of the project
- Type and number of turbines used
- Expected annual generation

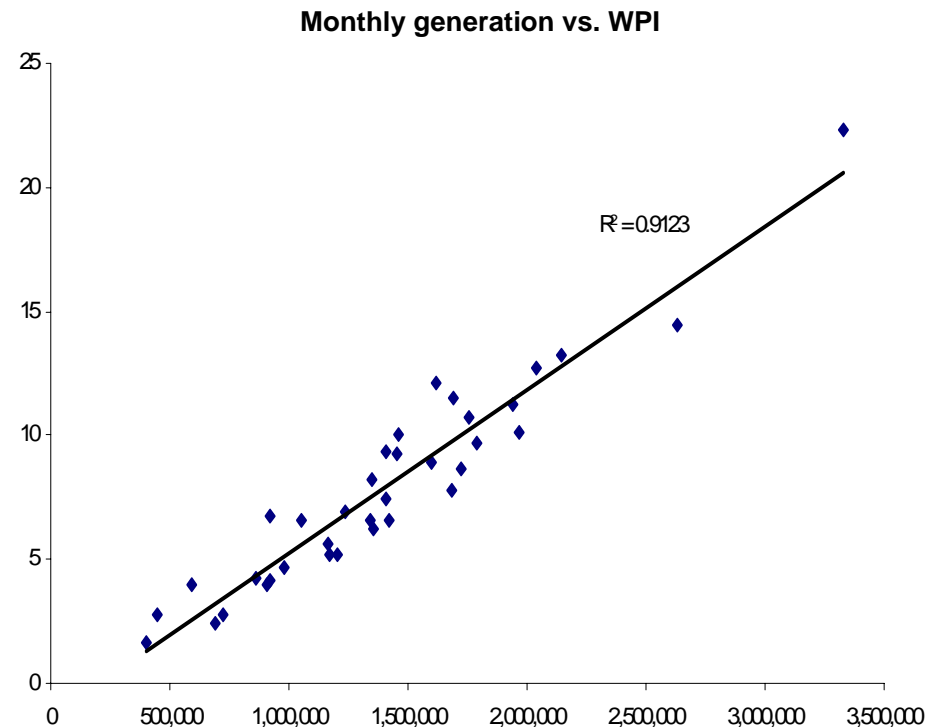
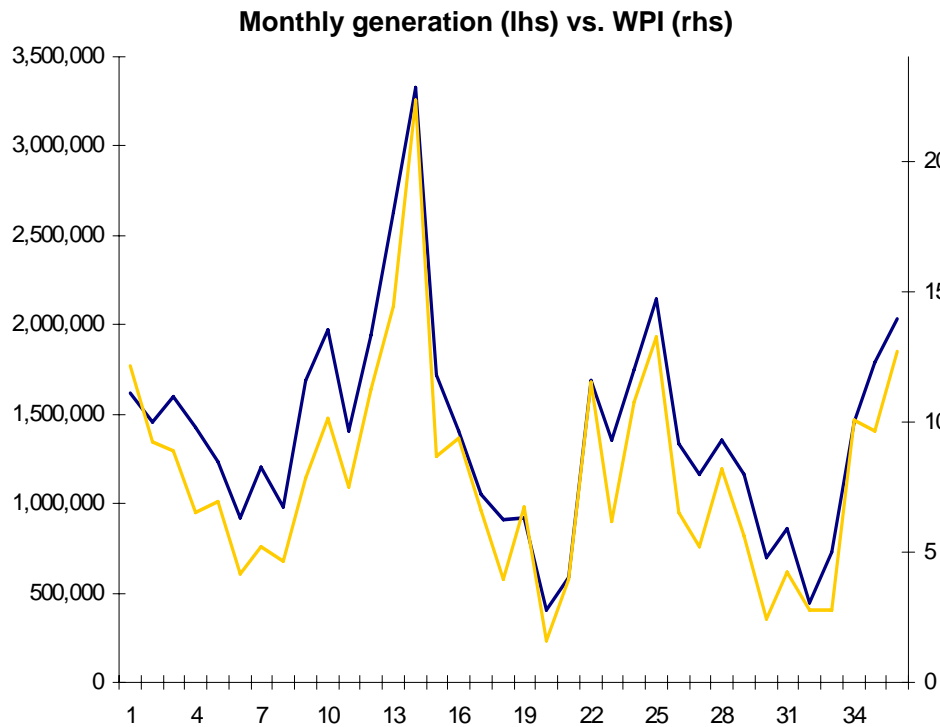


## Example Wind Farm Project: Historic WPI

- Local Wind Volumes Usually Vary by More Than  $\pm 20\%$  from the Long-Term Average



## Actual Generation Output Highly Correlates with Modeled WPI



Source: MLGC model, 36 months of actual generation data from German wind farm

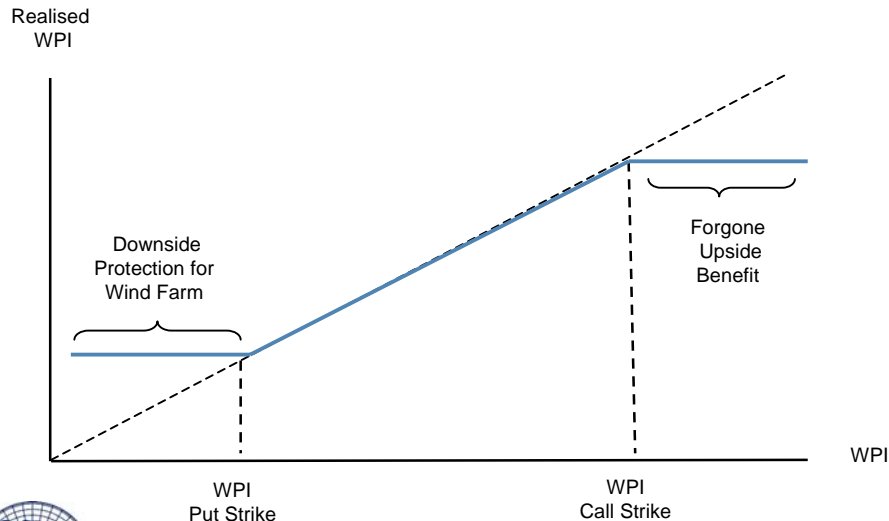
## Example Wind Farm Project: Hedging Instrument

### WPI Hedging Strategy: Zero-Cost Collar

Under this agreement, the buyer pays the seller if the defined weather index falls below the put strike and the seller pays the buyer if the weather index turns out above the call strike.

The payment in either case is equal to the number of units the weather index deviates from the strike times the tick size, up to the maximum payout limit.

No upfront premium needs to be paid.



### Indicative Terms and Conditions

<b>Instrument:</b>	Zero-Cost Collar
<b>Trade Underlying Index:</b>	WPI
<b>Buyer:</b>	Merrill Lynch
<b>Seller:</b>	WindCo.
<b>Tenor:</b>	01-Jan-2007 to 31-Dec-2011
<b>Put Strike:</b>	95
<b>Call Strike:</b>	100
<b>Tick Size:</b>	100,000 EUR
<b>Payout Limit:</b>	2,000,000 EUR
<b>Settlement:</b>	Annual

#### Index Statistics:

20-Year-Average:	100
Minimum (1971):	75.61
Maximum (1967):	126.83



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## Example: Temperature/Power-Quanto

	HDD - Threshold	HDD	HDD + Threshold
$(\text{Spot} - \text{FwdIndex}) / \text{FwdIndex}$	<p>Warm temps + Spot &gt; FwdIndex</p> <p>Sell unused power back to the spot market at prices &gt; FwdIndex</p>		<p>Cold temps + Spot &gt; FwdIndex</p> <p>Demand-driven swing structure covers price rise when buying additional power from the spot market</p>
	<p>Warm temps + Spot &lt; FwdIndex</p> <p>Demand-driven swing structure covers price drop when selling unused power back to the spot market</p>		<p>Cold temps + Spot &lt; FwdIndex</p> <p>Buy additional power from the spot market at prices &lt; FwdIndex</p>



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## Outlook

- Recent extreme weather events have further raised the awareness of corporates as well as energy producers and consumers to hedge their weather risks
- Increased interest from various industries in primary market should lead to continuous market growth as well as diversification by product and region
- Diversification in types of deals, e.g. increasing number of precipitation and wind deals in addition to temperature, is likely to continue due to strong build in renewable energy



**Thank you for your attention!**

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