Weather Risk Management

A challenge for the energy industry

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Executive Summary

Whether rain, drought or heat – during the past few years extreme weather conditions have been on the rise, and global warming is increasing. This trend is in line with forecasts being made by the Intergovernmental Panel on Climate Change (IPCC).

Energy companies are often subject to earnings fluctuations and financial risks as a result of temperature changes. Thus climate and climate changes must be considered a crucial risk factor for such companies. Sustained and active weather risk management is becoming a necessity for weather-dependent companies, to allow them to react to changing climate conditions.

In spite of the existing obligation for a company to describe material risks in its business report, the quantification and disclosure of weather risks in annual reports often leaves much to be desired. Particularly for listed companies with relevant weather risks, investors have the right to increased transparency, in order to be in a better position to assess the opportunities and risks involved.

This document points out the weather risks of utilities and uses examples to explain how weather derivatives can be applied as a risk management instrument by energy producers and energy distributors to smoothen their earnings.

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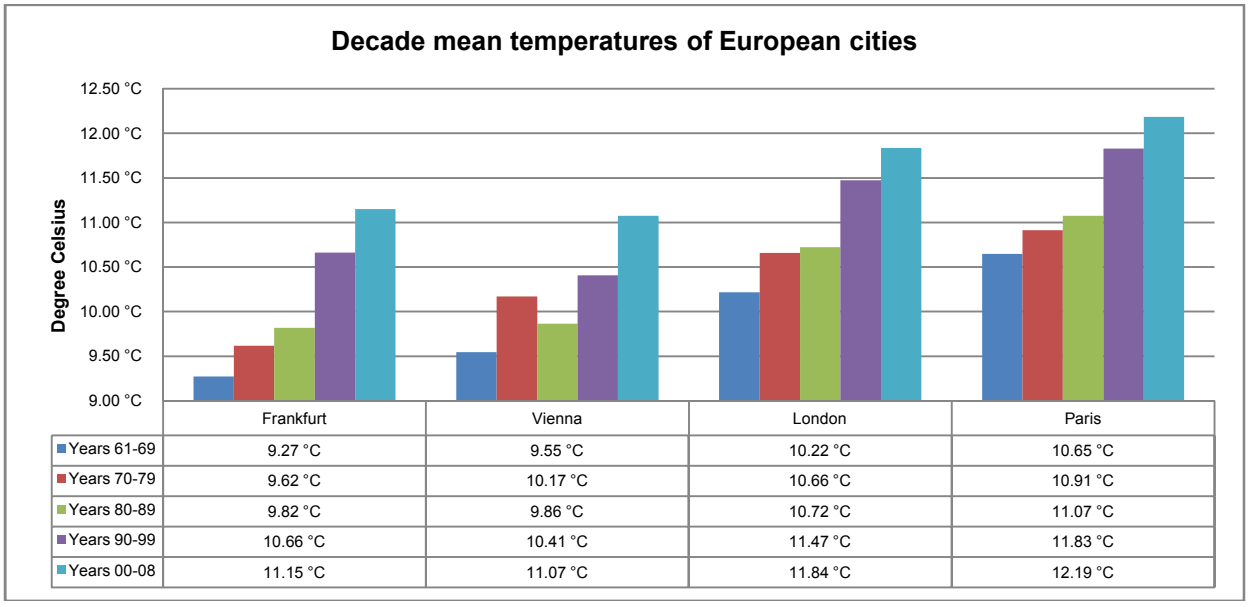
Climate trends in Europe

The forecasts by the Intergovernmental Panel on Climate Change[1] essentially show two climatic changes. On one hand there is a trend towards warmer temperatures; on the other hand there is a trend towards more variability, which inevitably leads to greater weather extremes.

Model scenarios for the year 2050 show an increase in temperature of approx. 2°C for large parts of Europe. But climate is not just changing in the future. Even a study of historical weather data shows a clear warming. Taking Vienna as an example, we find that the mean of all daily average temperatures during the period 1961-1969 was 9.55 degrees Celsius, while for the period 2000-2008 this figure rose to 11.07 degrees Celsius.



	Frankfurt	Vienna	London	Paris
Years 61-69	9.27 °C	9.55 °C	10.22 °C	10.65 °C
Years 70-79	9.62 °C	10.17 °C	10.66 °C	10.91 °C
Years 80-89	9.82 °C	9.86 °C	10.72 °C	11.07 °C
Years 90-99	10.66 °C	10.41 °C	11.47 °C	11.83 °C
Years 00-08	11.15 °C	11.07 °C	11.84 °C	12.19 °C

The increase in variability is particularly obvious during the winter months. A study of the average temperature of Paris during the past 30 winter half-years (October through March) shows that the year 08/09 was the fourth coldest. On the other hand, with an average of 8.89 degrees Celsius, the year 06/07 was more than 2 degrees warmer than the 30 year mean of 6.92 degrees Celsius.

		Frankfurt	Vienna	London	Paris
Winter 08/09	Average temperature	4.11 °C	4.48 °C	6.72 °C	5.81 °C
	Ranking within 30 years	8th coldest	average	6th coldest	4th coldest
Winter 06/07	Average temperature	7.60 °C	7.27 °C	9.00 °C	8.89 °C
	Ranking within 30 years	warmest	warmest	warmest	warmest
Mean value over the past 30 years		4.87 °C	3.92 °C	7.30 °C	6.92 °C

[1] http://www.ipcc.ch/

Weather risks in the energy industry

Energy producers

With regard to energy production, it is particularly the field of renewable energies that is weather dependent. For companies in this industry, weather is a location-related, crucial production factor. An increase in the variability of this production factor makes planning more difficult and increases entrepreneurial risk. Examples of weather dependencies are:

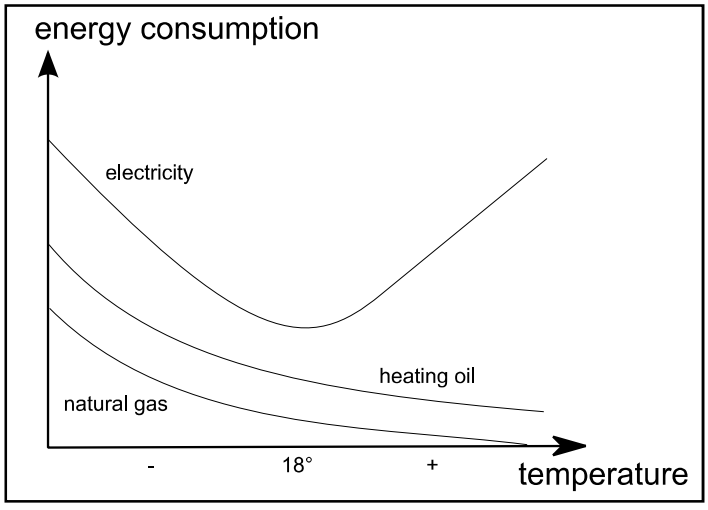
Hydroelectric power plants
Reservoirs and run-of-river power plants are fed by precipitation and snow. The main risks presented to producers are thus a dry summer season with little cumulative precipitation, a winter with little snowfall or an above-average cold spring that delays the snow melting.

Wind power station
Wind parks have an optimum level of efficiency at certain wind speeds.
When wind speeds are too high, plant operation must be cut back or even shut down completely. However the main risk is presented by years that have less than average wind.

Solar power plants
In photovoltaics, power is generated by global radiation. Besides seasonal fluctuations, global radiation also fluctuates from year to year. Because global radiation measurements are not available everywhere in adequate quality, sunshine hours can also be used as a basis for hedging.

Energy distributors

Temperature is a crucial driver for energy sales. The graph by the Institut für Energierecht at the Cologne University[2] illustrates the dependency of energy quantities on temperature. Power consumption at temperatures around 18°C is minimal. At colder temperatures the demand for energy increases due to heating requirements, while at higher temperatures it increases due to cooling requirements. Heating oil and natural gas are required mainly for space heating. Demand for these resources drops correspondingly as temperature rises.



[2] Wetterderivate, Daniel Seebach, Published by the Institut für Energierecht at the Cologne University

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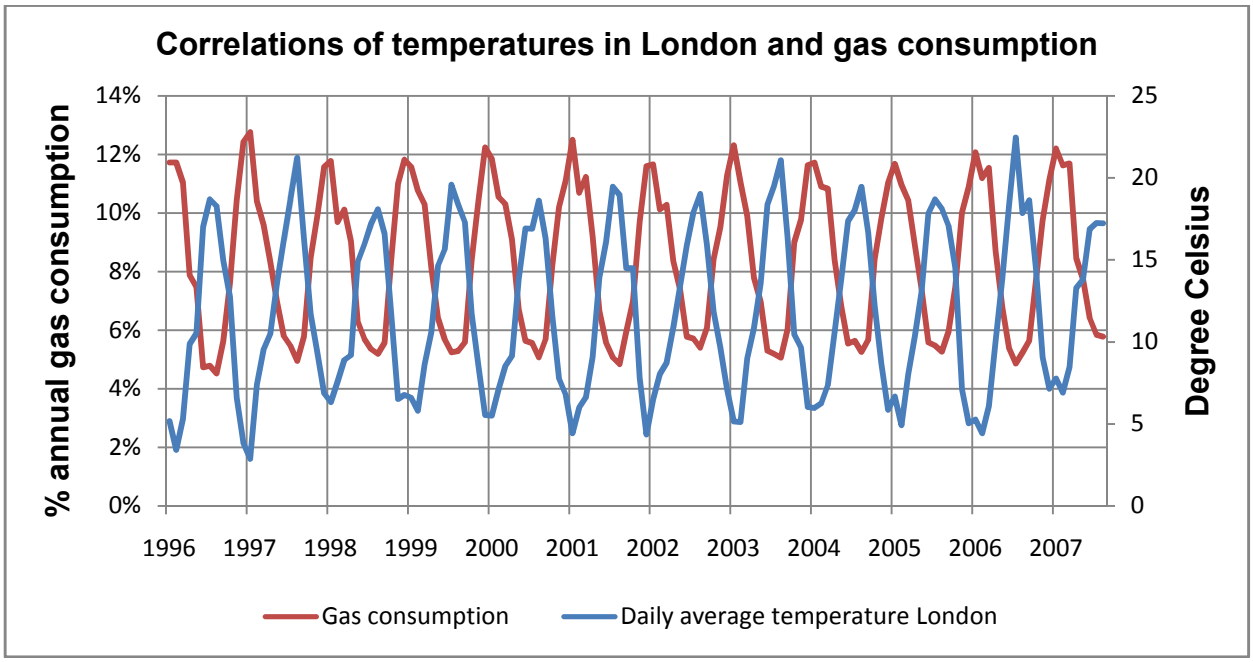
This dependency can also be shown with a correlation analysis. The example below, depicting the annual gas consumption in Great Britain in relation to the mean temperature in London, shows a correlation of 95%. According to a study by the National Grid[3], temperature is the main factor driving gas consumption, and can show a fluctuation of five to six percent per degree.



With such a strong dependency, it is clear that extremely warm winters such as during 2006/07 can have an immense influence on profit and sales figures. Thus, for the winter of 2007, the French national electricity company Electricité de France SA reported a 15.2% drop in net profits for the first half of the year, representing a decline from 4.14 billion Euros in the previous year to 3.51 billion.[4] This was explained by the lower sales experienced during the mild winter. Dow Jones Newswires also reported a noticeable reduction in gas and electricity sales by the German company MVV Energie AG as a result of the warm winter weather in the period 06/07. Since the beginning of its financial year in October, the group is showing 15% to 20% lower sales than in the previous year.[5]

In spite of the material influence of weather on earnings, these risks are generally still not being adequately quantified and disclosed. This is especially apparent in business reports, which rarely take up on the issues of climate change and weather risks.

[3] Short Term Gas Demand Forecasting, Lola Abiodun, National Grid
[4] Dow Jones, August 2007
[5] http://www.boerse-go.de/nachricht/Warmer-Winter-belastet-MVV-Energie,a545051.html

Poor transparency of weather risks for investors

Although climate dependency is obvious, there is a clear need for energy companies to catch up on transparency and to enlighten their shareholders of the risks that weather presents. In their business reports, only few companies disclose the opportunities and risks involved.

In a study published June 2009 on the disclosure of climate risks by publicly traded corporations[6], company filings are assessed in three main categories:

1. Emissions and climate change position
2. Risk assessment and risk quantification
3. Actions to minimize climate risks

The study concludes that many companies only poorly disclose the risks involved in climate change, in spite of the fact that weather risk presents a material risk to the company that must not be underestimated. Only three out of the 26 electric utilities ranked “Fair” on their disclosure of climate risks. None of the 23 companies in the oil and gas segment achieved a “Fair” score. Similar catastrophic reporting was found in other weather-dependent industries.

Securities law requires that any risks having a material influence on business activities must be disclosed. Hence, pressure by investors and analysts on companies to conduct transparent reporting and engage in active risk management will increase.

[6] www.ceres.org Climate Risk Disclosure in SEC Filings, June 2009, Authored by the Corporate Library, Ben Young, Celine Suarez, Kimberley Gladman

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Weather Risk Management

The dependency of utilities on a climate parameter is in most cases easy to determine with a correlation analysis. The next step quantifies how the contribution margin and/or profit changes in relation to the weather variable.

For ten years now it has been possible to pass on weather risk to a risk carrier. Similar to an option on the power price, which hedges the price risk, volume risk due to weather can be shielded with a weather derivative respectively a weather option.

Such a derivative is an individual contract defining weather conditions at a certain weather station, a period and payment modalities are defined. Historically measured weather data is used as a basis for calculating the premium. Similarly, the sole data used for making the payment are the measurement values made at the weather station during the risk period, so that no proof of damage is required. The measurement stations are thus of crucial importance. In order to ensure the quality of weather data, most weather derivatives are based on weather stations that meet the standards set by the World Meteorological Organisation WMO.

In principle, hedges can be constructed for all weather parameters relevant to the energy industry, such as temperature, precipitation, wind, global radiation or sunshine hours. Typical structures for energy producers are summarised in the following table.

Standard weather certificates for energy producers

Dry Season Certificate
The dry season certificate pays a pre-defined amount for every millimeter that the cumulative rainfall during a particular period is below a specified level.

Low Radiation Certificate
The dry season certificate pays a pre-defined amount for every KWh/m2 that the cumulative KWh/m2 during a particular period is below a specified level.

Low Wind Day Certificate
This certificate pays out a pre-defined amount for every day the mean wind force is below a specified level.

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The typical structures for energy distributors are Heating Degree Days HDD for the winter months. Here, the daily average temperature deviation from a threshold value (usually 18 degrees Celsius) is measured and summed up for the risk period. Such contracts are also transacted in standardised form at the Chicago Mercantile Exchange (CME).

Standard weather certificates for energy distributors

HDD Put Certificate
The Heating Degree Day (HDD) Put certificate pays a pre-defined amount for every HDD that the sum of the daily HDD's during a particular period is below a specified level.

CAT Call Certificate
The Cumulative Average Temperature certificate pays a pre-defined amount for every degree Celsius that the cumulative average temperature during a particular period is above a specified level.

Benefits at a glance

- Reduction in earnings volatility
- Easier to plan cash flows
- Tax optimisation
- Improved credit standing
- Lower capital costs due to better credit rating
- Sustained increase in corporate value

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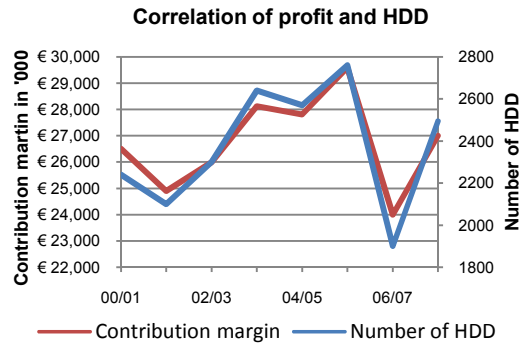
Example: Gas distributor hedging against warm winter

Correlation

Gas Ltd has found that there is a correlation of 95% between its gas sales and the heating degree days (HDD) in the region. Such a strong correlation can be observed for the entire gas industry.

To approximate its profits, the company multiplies the sales volume with an average sales price and an average margin.

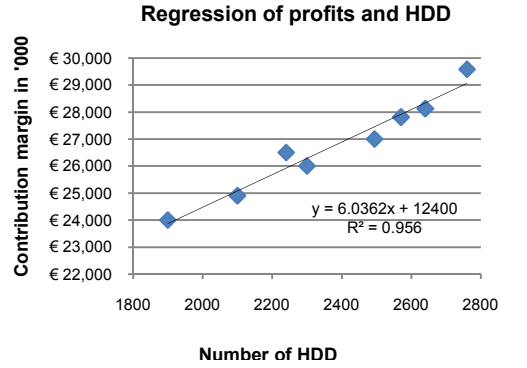


The graphic shows the correlation between the contribution margin and the cumulative HDD.

Regression

Gas Ltd uses a regression to calculate its profit variability. The result shows that a change of one HDD leads to a profit fluctuation of 6,000 EUR. Between a very warm and a very cold winter this would make a difference of EUR 6m.

In order to reduce this profit variability, Gas Ltd decides to use a weather derivative to secure a minimum profit of EUR 25.5m.



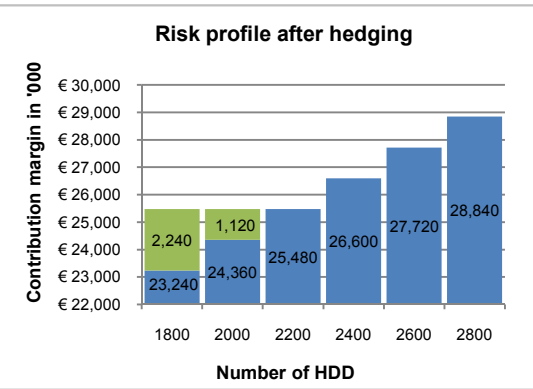
The graphic shows the regression between the contribution margin and the cumulative HDD.

Risk profile after hedging

Based on the analysis, Gas Ltd structures an HDD Put Certificate with the following parameters:

- Certificate: HDD Put
- Weather station: Zurich
- Period: 01.10.09 - 31.03.10
- Payout per HDD: EUR 6,000
- Maximum payout: EUR 2.25m
- Strike: 2200 HDD
- Premium: EUR 330,000

By hedging with an HDD Put Certificate, Gas Ltd has significantly improved its risk profile.



The graphic shows the change in contribution margin less the cost of the premium as well as the payment of the certificate (green).

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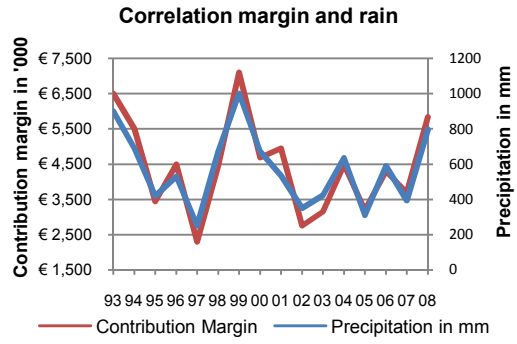
Example: Hydro power plant hedging against low precipitation

Correlation

Hydro Ltd has found that there is a correlation of 94% between its MWh energy in the reservoir and the cumulative precipitation in the region. Such a strong correlation can be observed in many hydro-electric plants.

To approximate its profits, the company multiplies the MWh with an average sales price and an average margin.

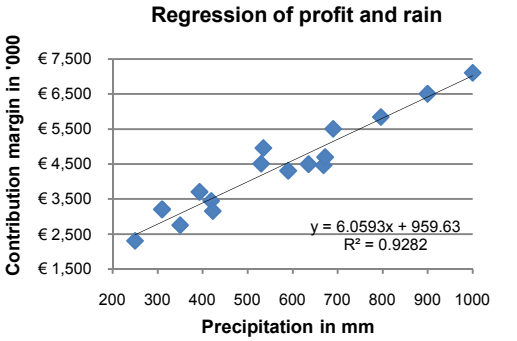


The graphic shows the correlation between the contribution margin and the cumulative precipitation.

Regression

Hydro Ltd uses a regression to calculate its profit variability. The result shows that a change of one mm precipitation leads to a profit fluctuation of 6,000 EUR. Between a wet period and a dry period this would result in a difference of EUR 4.5m.

In order to reduce this profit variability, Hydro Ltd decides to use a weather derivative to secure a minimum profit of EUR 3.5m.



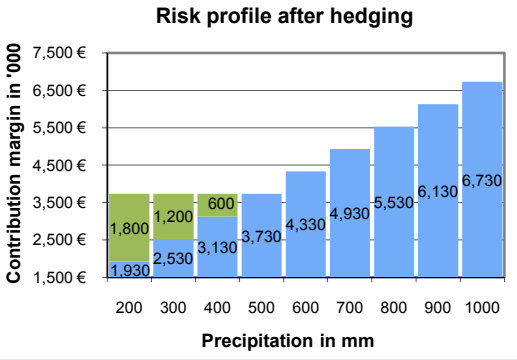
The graphic shows the regression between the contribution margin and the cumulative precipitation.

Risk profile after hedging

With the help of this analysis, Hydro Ltd structures a Dry Season Certificate with the following parameters:

- Certificate: Dry Season
- Weather station: San Bernardino
- Period: 01.08.09 - 31.10.09
- Payout per mm: EUR 6,000
- Maximum payout: EUR 1.8m
- Strike: 500 mm
- Premium: EUR 270,000

By hedging with a Dry Season Certificate, Hydro Ltd has significantly improved its risk profile.



The graphic shows the change in contribution margin less the cost of the premium as well as the payment of the certificate (green).

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CelsiusPro

CelsiusPro is a Swiss company specialised in the structuring and sale of individual weather certificates. The company offers European businesses and private customers uncomplicated and transparent weather coverage, to protect revenues or limit costs against adverse weather.

Beside classic consultations and structuring, customers and interested persons can visit the company's website at www.celsiuspro.com to directly calculate and purchase weather certificates online. The offer currently includes 15 standard certificates based on different weather variables and more than 100 weather stations across Europe. More specialized weather coverages are offered upon request.

CelsiusPro has a strategic partnership for weather risk management and risk transfer with Swiss Re, a world-leading reinsurer.

CelsiusPro is a member of VQF the Financial Services Standards Association and the Weather Risk Management Association (WRMA).

We would be pleased to help you with any questions. Contact us!

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Zurich, July 2009