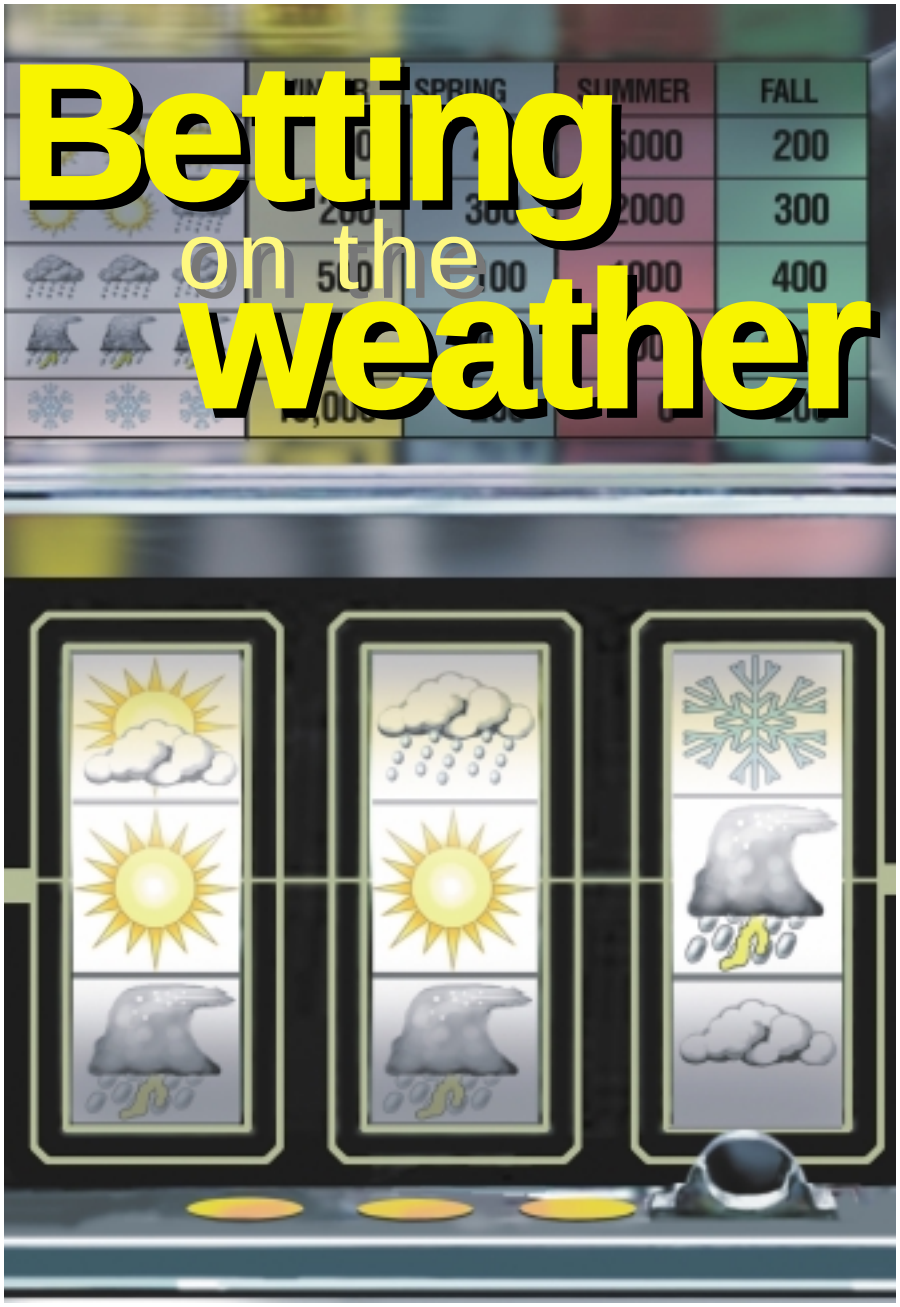
Betting on the weather



Four years ago, two U.S. power companies entered into the first weather derivative 'swap' contract. Since then, weather derivatives for vendors of energy and other products and services have become a multi-billion-dollar niche market for insurance companies and the trading operations of sophisticated energy firms

By Anne Ku

Weather affects all types of businesses. A crop or dairy farmer's year could be ruined by an extended heat wave or cold snap, a drought, or excessive rainfall. The profits of amusement parks and ski areas likewise depend on long periods of the "right" kind of weather. But weather affects "indoor" businesses as well. Sales of water, beer, and soft drinks—and air conditioners and bathing suits—rise with temperature, but collapse during cooler-than-usual summers. The U.S. Department of Commerce says that weather affects 70% of American companies, and as much as 22% of America's $9-trillion GDP.

The revenues of energy companies are affected by weather too, on a seasonal basis. Retailers of natural gas, propane, and heating oil benefit from colder-than-normal winters, when consumers and businesses buy more fuel to warm their homes and offices. During hot summers, electricity suppliers sell more kilowatt-hours to run air conditioners. Conversely, energy companies' earnings fall during warm winters and cool summers.

For energy companies, then, the unpredictability of temperature increases what academics call their volumetric risk or volumetric exposure. Denominated in dollars, this figure is a measure of the uncertainty of demand and, therefore, revenues. Because it also takes into account the impact of prices on demand, volumetric risk for energy companies has risen as deregulation has made energy prices more volatile.

In fact, deregulation could be considered the primary driver of energy companies' increased awareness of—and steps to mitigate—weather risk. As Andrew Feacham of Eurobrokers points out in a new book (see p. 53), since Koch and Enron made the first "degree-day swap" in 1997 (see box, p. 29) energy companies now commonly use weather derivatives to hedge their volumetric risk. For more on the kind of weather derivative deals that Enron offers today, see box, p. 31.

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Just under 5,000 weather contracts have been transacted between October 1997 and April 2001, according to the latest comprehensive study of the weather market, conducted jointly by PriceWaterhouseCoopers and Washington-based Weather Risk Management Association (WRMA), the international trade organization of the weather risk management industry. Altogether, these deals covered about $7.5 billion of total exposure. According to Weather Risk Advisory Ltd., Cambridge, England, the market is expected to grow to at least $300 billion within a few years, around the same as the power and gas markets. Typical deals range from $2 million to $30 million.

Gas prices and weather risk

Because gas companies sell it and power companies burn it, natural gas is a commodity whose weather risk is of concern to both types of energy firm. Weather makes gas prices volatile during both the summer and winter. During unseasonably cold winters, demand for gas from heating customers can skyrocket, as can demand from power generators during very hot summers. In both cases, inventories are depleted and prices spike.

Many utilities manage this volatility by using gas futures markets to hedge gas acquisition costs. But companies that guess wrong about future prices risk sizable financial consequences and leave themselves open to criticism by customers and regulators. Compounding the problem, the natural gas market has recently been more volatile than ever; over the last 12 months, it has gone through periods of prices spiking both up and down. One new way to tackle this problem is represented by Planalytics' Weathernomics Gas Buyer (see box, p. 32).

Not just temperature

In most cases, the term "weather risk" relates to a company's volumetric exposure to the effect of unseasonable temperatures. Most weather derivative contracts are based on industry-standard daily temperature indices —such as heating and cooling degree days (see box, p. 30).

However, energy companies can also hedge against the effects of other manifestations of unusual weather. For example, Element Re, Stamford, Conn., recently "insured" a German utility against the loss of power sales revenues that might result from an unusually rainy summer. Most of the utility's customers are farmers who must buy electricity to run irrigation pumps when there's a shortfall in rainfall. Based on precipitation measurements by the German Meteorological Agency, the deal pays the utility in euros when there's plenty of rain—and the farmers can irrigate their land without pumps.

As it happens, one of the Agency's weather stations is very close to the farmers' fields, and that was a very important factor Element Re considered in structuring this deal. Rainfall is a very localized phenomenon; it can rain on one side of the street and not the other. According to Lynda Clemmons, Element Re's president and chief operating officer, this is one of the first weather deals to help protect utility revenues against an unusual amount of rainfall—rather than unusual temperatures. Element Re, whose staff includes many weather derivative experts formerly with Enron, is a subsidiary of the worldwide insurance firm XL Capital Ltd.

The art—and data—of the deal

About half of weather derivatives deals

Notable dates in the history of weather derivatives

September 1997: Enron and Koch transact first degree-day swap.

Winter 1997: Strong El Niño produces unusually warm winter in the U.S., making weather's impact on American economy front-page news.

September 1998: First international weather derivative, between Enron and Scottish Hydro.

June 1999: Weather Risk Management Association (www.wrma.org) founded in Washington by major marketers of weather derivatives.

September 1999: Chicago Mercantile Exchange (www.cme.com) creates first exchange for degree-day swaps.

October 1999: First weather bonds marketed (Enron) and placed (Koch).

December 1999: I-WeX (www.i-wex.com), a London-based consortium, including the London International Financial Futures & Options Exchange, opens first electronic weather derivatives exchange.

January 2000: First weather contract traded on EnronOnLine.

September 2000: First natural gas-based precipitation "collar" transacted for a California municipality.

May 2001: Risk Management Solutions (www.rms.com), Newark, Calif., introduces first widely available data set and pricing model.

July 2001: London International Financial Futures & Options Exchange (www.liffe.com) launches three European weather indices based on monthly mean of daily average temperatures in London, Paris, and Berlin.

The terminology of weather derivative indices and instruments

Daily weather indices

HDD: Heating degree days, 65F minus the average daily temperature (never negative, zero when warmer than 65F).

CDD: Cooling degree days, average daily temperature minus 65F (never negative, zero when cooler than 65F).

EDD: Energy degree days, HDD + CDD.

GDD: Growing degree days, degree days between 50F and 86F.

VDD: Variable degree days, 65F base is replaced by another temperature.

The most basic weather trading instruments are caps, floors, and swaps:

- Caps, also known as call options, provide a buyer with a linear payout based on the difference between the actual index value and a predetermined value or strike. If the actual index value is below the strike, no payment is made. The buyer of a cap must pay a premium to the cap seller for the right to the payout.
- Floors, also known as put options, provide a buyer with a linear payout based on the difference between the strike and the actual index value. If the actual index value is above the strike, no payment is made. As with a cap, the buyer of a floor must pay a premium to the floor seller.
- A swap is a combination of a cap and a floor at the same strike. If the actual index value is above the swap level, the seller of the swap makes a payment to the buyer of the swap. If the actual index value is below the swap level, the buyer of the swap makes a payment to the seller of the swap. There is no premium required to enter into a swap transaction.

Unlike other financial or commodity options which have unlimited payouts, weather instruments are typically structured with a fixed payout amount. The payout amount is negotiated in a weather contract and limits the option seller's potential loss. Therefore, weather options are similar to financial or commodity call or put spreads.

Caps and floors can be combined in various ways to create a collar. For example, a fuel oil distributor may desire to protect his revenues from the risk of a warmer-than-normal winter. The distributor would like to purchase an HDD put and is willing to limit the benefit of a colder-than-normal winter by selling an HDD call to finance the purchase of the HDD put. If the premium of the call exactly offsets the premium of the put, then the collar is costless or zero cost.

In addition to the basic or vanilla instruments described above, several exotic weather instruments are also available. These include:

- Compound options—options to purchase or sell options.
- Digital options—options that payout a fixed amount if a particular weather event (or series of weather events) occurs.

Source: Axia Energy LLP

are brokered. The more informed a customer is, and the more relevant historical data about demand he or she can provide, the quicker a weather derivative deal can be priced and structured. In the above case, the German utility first approached Spectron, a London-based broker specializing in energy commodities, which then called around and referred Element Re.

While this rainfall deal marks Element Re's debut in the European market, Clemmons says that the lack of good weather data poses a serious impediment to the growth of weather derivatives there. Unlike in the U.S., where the National Weather Service provides topnotch weather data free of charge, European weather data aren't collected by a single entity—or given away.

Insurance or derivative?

Nick Ward, head of new markets for Spectron, considers Element Re's rainfall deal indicative of the convergence of insurance and derivative approaches to weather risk management taking place today. It combines aspects of flood insurance—which provides coverage against the occurrence of an event—with those of derivatives—which use an upfront formula to calculate a payout based on the value of some weather variable.

Ward adds that in Europe, most of the action in weather contracts is in Great Britain, with Germany and Scandinavia close behind. To him, energy companies and weather risk mitigation are a good fit because the weather variable that affects energy companies' revenues most is temperature, which is easy to measure and model. By contrast, wind and rain are much more localized, and if there's no weather station to capture an event, a derivative deal would be impossible to structure.

Contributing to the dialog on this subject, Tom Ruck, senior vice president of Houston-based Axia Energy LLP, says that he really doesn't see any shift from weather derivatives to insurance taking place. What he does see in the weather market, however, is energy companies favoring derivatives for one-year deals, and non-energy companies favoring insurance. For multi-year deals, Ruck adds, an insurance policy seems to be the preferred vehicle—but not many are being writ-

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ten. Typically, he explains, short-term hedges can be done more cheaply as a derivative than as insurance. Axia Energy, the joint-venture trading arm of Koch Energy Trading and New Orleans-based Entergy, offers a broad range of commodity risk-management tools to energy companies.

Hedging or speculating?

Despite the rapid growth in the popularity of weather derivatives—from zero to thousands of deals in just four years—a "technicality" seems to be slowing their proliferation. That technicality comes in the form of a question: What is a weather derivative, in accounting terms?

If a weather derivative is indeed an insurance policy, corporate accounting rules clearly spell out how it should appear on a balance sheet. But if it is a different breed of beast, the rules are not as clear. Specifically, what troubles corporate accountants is that weather derivatives are not mentioned in Financial Accounting Standards Board (FASB) Standard 133, which—this year, for the first time—requires companies to do what's called "hedge accounting."

What that means is that if a company buys or sells a derivative, it must

Power demand swaps: Hedging power with weather derivatives

The U.S. wholesale electricity market is currently suffering from pronounced liquidity gaps, making it increasingly difficult for power traders to purchase call options at reasonable prices. Fortunately, a new source of liquidity has recently become available: demand swaps.

The demand swaps, which are available at EnronOnline, pay out based on weekly demand in the PJM and New England power pools. They are a class of weather derivatives because the variability of demand there and elsewhere depends primarily on temperature. Soon, Enron will also list monthly contracts for the entire season, and offer similar products for other power pools. For example, demand swaps for the New York Power Pool are expected to become available this August.

Weather derivatives began as instruments for energy consumers and suppliers to hedge the volumetric risks of unseasonably hot and cold weather. An energy utility, for example, could purchase a floor on seasonal heating degree days, which would pay out in proportion to the difference between actual and expected energy usage. Likewise, power demand swaps address exposure to load volumes.

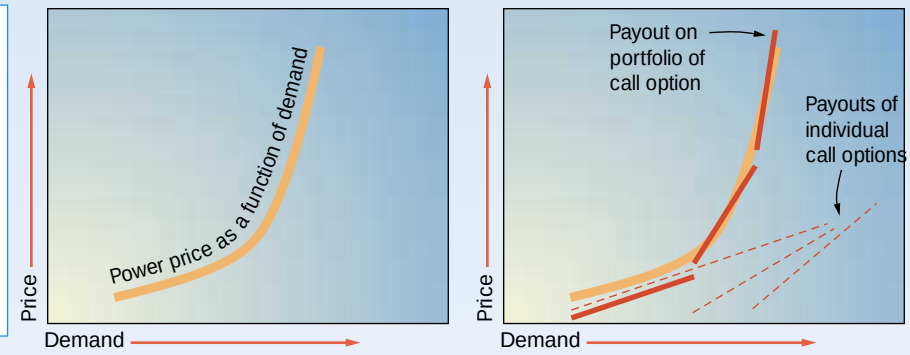
By Joseph Hrgovcic

However, sophisticated power traders can use weather derivatives to manage price risk as well. Indeed, a skilled trader is, in general, able to estimate how changes in forecasted temperatures affect demand as well as prices. The trader can then construct a portfolio of demand call options of differing strikes whose payout profile is similar to that of a call on power (figure).

Obviously, the demand/price relationship is subject to interruptions in power supply or demand, so the correspondence will be inexact. However, in today's power markets, such synthetic calls provide the best opportunities to "go long" on power. These demand products can therefore be used to fill the capacity gaps in both power and weather derivative markets.

Here's how the demand swaps work in practice: The standard contracts traded on-line pay $10 for each megawatt difference from the agreed swap price, which is denominated in megawatts. For instance, if party A agrees to sell a swap at 35,000 MW to party B, and the actual outcome is 36,000 MW, then party A owes party B $10,000 ($10 x the MW difference) per contract. The products are as easy to trade as all other EnronOnline products, with a few mouse clicks. As with all EnronOnline transactions, higher-volume and customized products can be purchased as direct over-the-counter transactions. Also, options as well as swaps can be transacted.

Because weather derivatives have been available for some years, demand swaps could in principle have been available sooner. However, calculating the appropriate coefficients that relate demand to transactable weather products is not a trivial task. The introduction of demand swaps places the burden of the calculation on the part of the weather marketer, allowing power marketers to transact weather in terms they are accustomed to. In the future, analogous products will likely be made available to other energy traders.



A given price vs. demand curve (left) can be approximated by a portfolio of power demand options (right). Depicted in this example are three call options

Joseph Hrgovcic is head of weather derivatives research for Houston-based Enron Corp. He developed the models used to price and manage the first weather derivatives.

Managing weather-related gas price volatility

Weathernomics Gas Buyer is a financial risk management tool for purchasing and hedging natural gas that factors in the impact of weather on natural gas inventories and prices. On a daily or weekly basis, the Web-based tool—which users can access after buying an annual subscription—provides them with cost-effective suggestions for buying natural gas for each of the next 12 months. It takes a long-term view, spreading purchases and the related risk out over one year.

Commercialized last year by Planalytics, Wayne, Pa., Weathernomics Gas Buyer is being used by utilities, energy companies, and large industrial end users of natural gas. They are attracted by talk among early adopters about quick ROI and impressive savings. Planalytics reported in June that clients basing their purchases on Weathernomics Gas Buyer's suggestions would have paid $0.59/million Btu less than the average month-end settlement price over the last 12 months. That represents a saving of 11%.

Weathernomics Gas Buyer does not attempt to forecast natural gas prices in a traditional sense. Rather, it forecasts the turning points and future direction of prices to determine if natural gas is overvalued or undervalued at any given time. Weathernomics Gas Buyer combines long-range weather intelligence, American Gas Association weekly storage data, inventory change forecasts, real-time Nymex futures contract pricing, and proprietary technology into an engine that provides six possible buy/sell outputs. Weathernomics Gas Buyer is not based on mathematical or statistical probabilities of weather, but rather on proprietary long-range weather forecasts from Planalytics.

By James Gagne

James Gagne is a senior vice president of Planalytics, Wayne, Pa.

show that the purchase was a true and fair hedge. That means getting historical and third-party data to prove that the intent of the purchase isn't speculation. This is hard for most companies that don't do "mark-to-market" accounting—valuing their portfolio at the end of each business day. Only energy traders and banks do that. Most companies do what is called "accrual accounting"—they only tote up the value of the assets once a quarter or once a year, as FASB 133 says they must.

The problem: What FASB 133 also says is that companies that use accrual accounting but use derivatives to hedge must account for those derivatives in a different way: at least once a quarter, and with proof that the decision to purchase or sell the derivative was a sound one (hence the need for historical data). It is thought that this requirement has resulted in companies transacting fewer derivatives—not just weather derivatives, but futures and options as well.

The nature of weather derivatives remains unresolved and open to debate. For example, Ruck of Axia believes that weather products do not fall under the jurisdiction of FASB 133 because technically they are not commodities. He thinks that accounting for them should be done according to the principles of the FASB's Emerging Issues Task Force Issue EITF 99-2 of July 1999.

Visit these sites for more information

www.axiaenergy.com
www.cme.com
www.elementre.com
www.enron.com
www.i-wex.com
www.planalytics.com
www.rms.com
www.spectrongroup.com
www.weatherriskadvisory.com
www.wrma.org

Ruck adds that the issue of whether a weather contract is a derivative or insurance boils down to individual company managers' relative comfort levels with the two products. Some CEOs, CFOs, and boards of directors, he explains, lack experience with financial hedging, so they are more apt to secure insurance coverage. For others experienced with both types of risk-management products, tax and accounting considerations usually determine whether one product or the other is used. (For more on this subject, visit www.axiaweather.com/html/ acctissues.html.)

Regulatory rules may also be constraining the use of weather derivatives. Recently, Dallas-based gas distributor Atmos Energy Corp. wanted to buy protection from warmer-than-normal weather. Although the company had done a derivative transaction the year before, the Texas Public Utility Commission refused Atmos's request to transact a multi-year derivative contract.

In response, the company bought a multi-year insurance policy from Element Re. President and COO Lynda Clemmons explains that one reason companies often turn to her firm is that managers find it easier to tell their board of directors that they've bought an insurance policy—rather than a derivative.

No more excuses

Despite the accounting uncertainties surrounding weather derivatives, it's clear they have become part of the energy risk manager's toolbox. A recent survey of 200 top U.S. utility company annual reports reveals that 80% cited weather as a major determinant of earnings performance, and about 50% stated that weather was responsible for poorer than expected financial performance. Ruck believes it won't be long before Wall Street equity analysts lose patience with companies that blame weather for lower earnings. When they do, CFOs will have to realize that their company's exposure of earnings to weather not only can be—but must be—hedged. ■