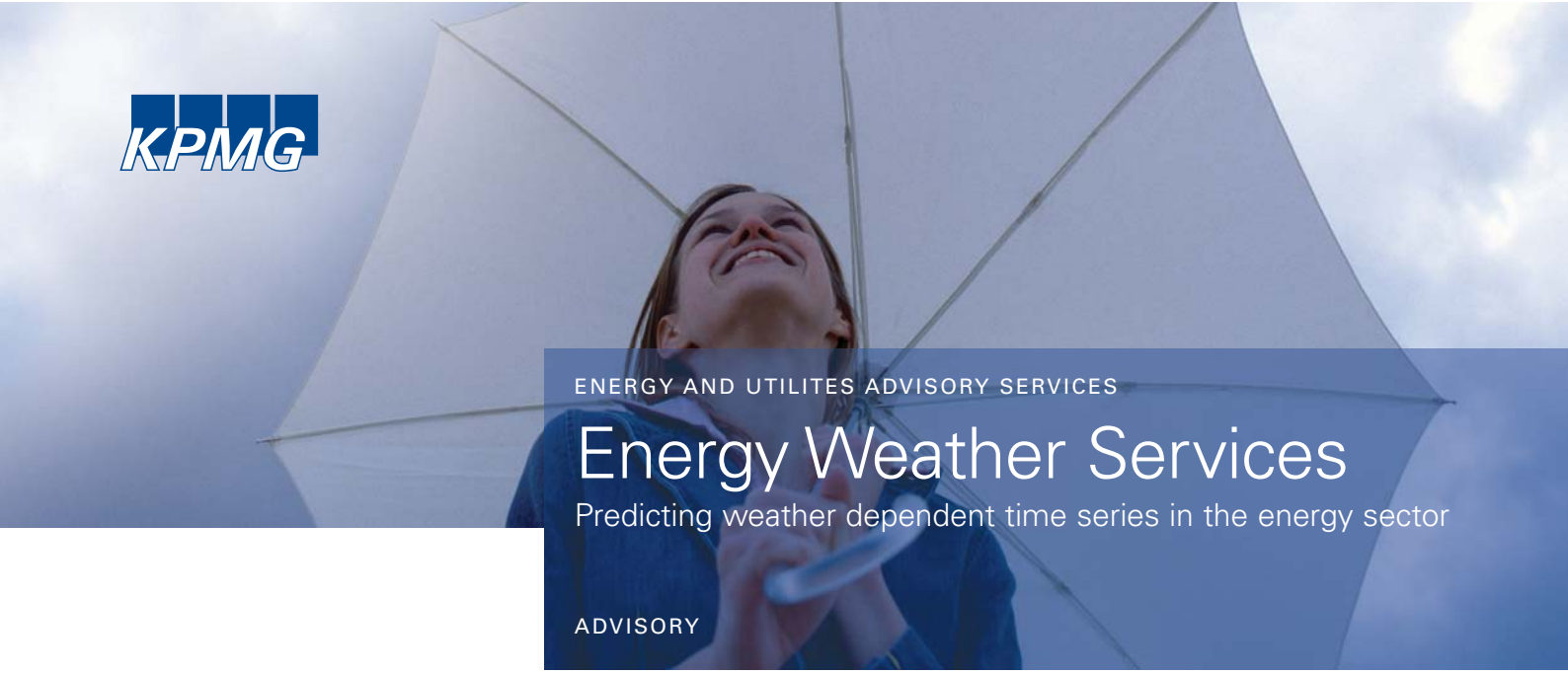

ENERGY AND UTILITES ADVISORY SERVICES

# Energy Weather Services

## Predicting weather dependent time series in the energy sector

ADVISORY

**KPMG`s Energy Weather Services (EWS) solution's core is a weather forecasting engine (module). EWS covers the whole range of energy sector forecasting needs (operation planning, generation, trading, transmission, distribution, outage service, etc.). Its forecasting horizon is adaptable to particular needs of the energy sector (short-, medium-, and long-term horizons). Originally developed for the purposes of energy load forecasting, currently it represents a robust tool applicable in many other areas. It can be useful in any sector which is influenced by weather (road maintenance services, transportation, agriculture, supply for retail chains, local governments, leisure services, etc.).**

**The basic concept of the EWS solution originates from the following premises:**

- Unique forecasting know-how and unique set of tools
- Strong partnership with world leaders in the forecasting business
- Long term experience in weather and time series forecasting.
- References from successful forecasting projects
- Reliability proven by many years of operation.

### Weather Forecasts

The weather forecasting module uses global short-term NCEP model forecasts as its primary input. NCEP produce forecasts for more than 300 types of 3-D weather fields with 0.5 degree granularity based on ground and ocean measurements, soundings (meteorological balloons measuring vertical profiles) and satellite data. These global forecasts are adjusted by tools of statistical adaptation to local conditions. These adapted forecasts include energy sector relevant meteorological variables, e.g.:

- Atmospheric pressure
- Temperature
- Wind
- Humidity
- Radiation
- Cloudiness
- Rainfall and indicators of extreme weather events, e.g.storms, lightning or ice.

Statistically adapted forecasts generated by the weather forecasting module are high quality, tailor-made forecasts of numerous meteorological variables for any desired location. Such forecasts are particularly useful and consistent for application in any further statistical modelling, e.g. load forecasting or network outages forecasting.

### Load Forecasts

Our team has extensive experience acquired in numerous energy load forecast projects. We apply specialised software using sophisticated mathematical tools that are designed for data processing and load modelling. A high quality weather forecast is, of course, the key input. Short-, medium-, and long-term load forecasting is composed of the following steps:

- Data cleaning – historical load and weather time series
- Models of statistical adaptation designed to provide the most appropriate weather forecasts as input for load forecasting
- Long-term normal weather time series analysis including confidence interval computation and VAR analysis
- Design and estimation of statistical models applicable for short-term and long-term hourly load forecasts
- Closed form evaluation or Monte Carlo simulation of long-term forecasts' confidence intervals and volumetric risk analysis
- Interface and application configuration for automatic data transfers and load/weather forecast generation.

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### Potential benefits of KPMG`s EWS solution

The EWS solution can effectively address the following:

- Our experiences from numerous forecast projects facilitate quick implementation (approximately six months), high quality, and prompt return on a client's investment in the project.
- Load forecast process automation with minimal operational time requirements.
- Our robust forecasting systems enable generation of short-term forecasts (next day/8 days) with possible prolongation of the forecast time horizon (to weeks, months, or years).
- Automated data capture and tracking of, forecasted values and meteorological variables necessary for regular system calibration that ensures continuous improvement of the accuracy of forecasts.
- Generation of useful forecast databases containing time series of historical values, meteorological variables, and calendar data.

### Network Outages Forecasts

Network outages forecasts, like load forecasts, build upon our tailor-made prediction of selected meteorological variables and indicators that have significant influence on outage rate.

Forecasts of network outages represent a valuable input for the management of distribution and transmission networks, mobile field force management, and also represent a complement to load forecasts. The outage forecasting process is analogical to the load forecasting process except for the need to employ specific limited dependent variable estimation procedures (e.g. Poisson regression) in order to design consistent statistical models:

- Data cleaning – historical network outages and weather time series
- Models of statistical adaptation designed to provide the most appropriate weather forecasts as input for network outage forecasting
- Long-term normal weather time series analysis including confidence interval computation and VAR analysis
- Design and estimation of statistical models applicable for short-term and long-term hourly network outages forecasts
- Interface and application configuration for automatic data transfers and outages/weather forecast generation.

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