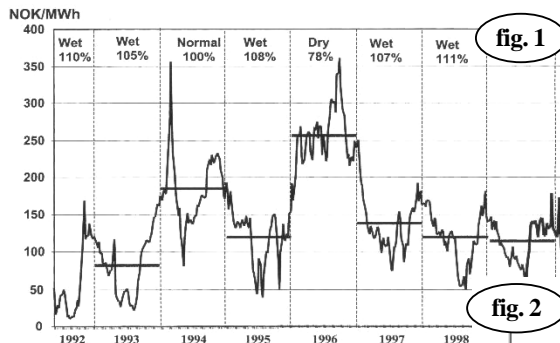


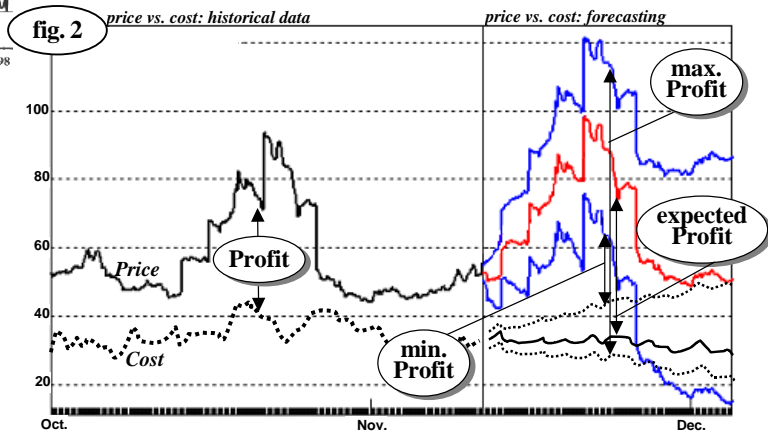


Forecasting and Risk Assessment on Electricity Markets



The Problem: Liberalization of energy market, especially of electricity prices in Europe has been a challenge for virtually everybody participating in this business: from production planners to the end-user, but primarily for energy traders. Although the lessons from the mature markets like the oil derivatives one have been precious, the specific features appearing in the area of electricity trading are often different and special, customized, solutions are needed. These specific problems arise mainly due to:

- ❑ “youth” of the market – no history / records, instability of prices which can easily vary within a range of 10 times – see fig. 1 showing prices in Norway, since liberalization!), no experience on effects of other influencing events...
- ❑ interaction with other markets (e.g. cross commodity trading, markets in other countries)
- ❑ lack of standardized methods for risk management in absence of reliable data.



The interest in the issue is currently booming in Europe (since the early birds like Norway which started the liberalization up to late-comers like Germany), as well as the companies offering possible solutions: traders, risk managers, consultants, analysts, software houses... Most of them looking for the answer how the uncertainties in the forecasted prices (and costs – see fig. 2!) will influence future profits and most of them basing their predictions on statistical methods and VAR-analysis. However, when data are missing, when inputs are uncertain, as they are in the case of energy trading, the conventional statistics shows its limits. New solutions are needed.

Our Solution: Use of “intelligent methods” of data mining (neural networks, fuzzy technologies, genetic algorithms, etc.) in electricity trading allows to:

- ❑ treat/reconstruct the missing values better,
- ❑ make more accurate prediction and narrow their scatter bands,
- ❑ speed up predictions and/or make them cheaper,
- ❑ involve and/or model the factors influencing tails of the distributions of possible outcomes (i.e. model influence of exceptional events, not or weakly present in historical data).

The “intelligent tools” should appear as “add-ons” for existing analytical (e.g. statistics-based) solutions – not as their replacement. The “intelligent tools” like e.g. data mining software DataEngine™, comprising fuzzy technology, neuronal networks and other “intelligent methods” (e.g. for feature selection), should be used for enhancing of conventional (e.g. statistical) tools.

Example – “blind” analysis and forecasting of electricity prices made on a sample data on energy prices in Germany, using DataEngine™ and other tools has covered:

- ❑ statistical analysis (e.g. using ARIMA etc.), with a lot of analyst's interaction
- ❑ genetic algorithm based enhancement of parameters of statistical analysis
- ❑ neural networks based feature selection
- ❑ neural networks based forecasting

Main results obtained were:

- ❑ prediction / forecast of price(s) on a given date
- ❑ probability of the forecasted price
- ❑ identification of "singularities" in time series (e.g. the last day of the month) and/or identification of influencing inputs (e.g. which preceding price, e.g. the one of "minus x days" influences the prediction predominantly)
- ❑ optimize the trading and/or plant operation/production strategy (see [fig. 3](#))

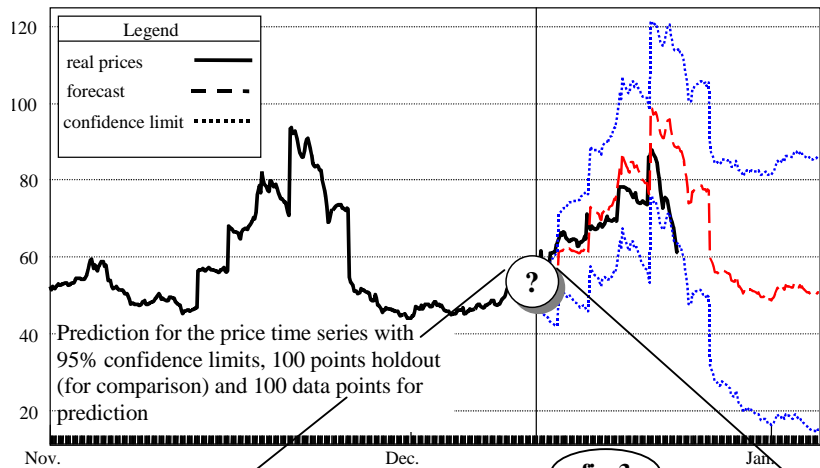
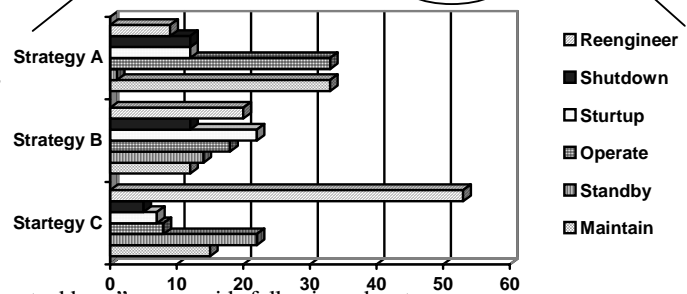


fig. 3



Deliverables –

what does the client get: Main

conclusions of the above exercise were that "intelligent add-ons" can provide following advantages:

- ❑ improved accuracy of forecast usually at the cost of comparably higher for the first analysis, and cheaper for the consequent ones
- ❑ better modeling of the effect of influencing factors (e.g. prices of other commodities, weather, seasonality, expert's opinion, etc.)
- ❑ more flexibility in analysis – i.e. ability to deal with situation not supported by abundant statistical data (e.g. when no trends or seasonality can be identified/modeled!), in such a case the advance method are the only chance to use other available information
- ❑ possibility to foresee the prices on a given day including information on the expected probability and priorities of possible strategies based on multiple criteria decision making (MCDM, [fig. 4](#)).

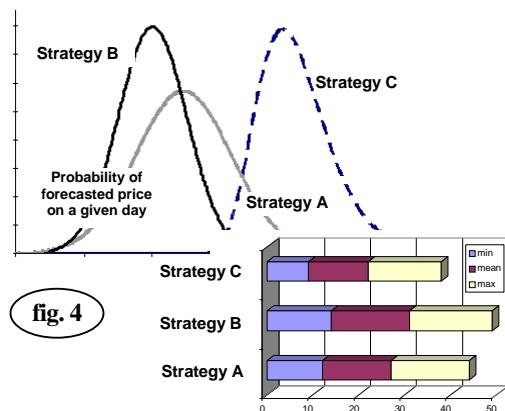


fig. 4

Advantage of prediction enhanced by intelligent tools is boosted further as soon as additional input (e.g. about the above mentioned "influencing factors"!) is provided.

In the final instance, using the intelligent methods, possibly combined with advanced methods for price forecasting and VAR analysis based may mean for the company improved risk management, prevention of losses / increased profits, and, thus, improved overall business practice.

Contact

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