

INTEGRATION OF FINANCIAL RISK WITH EFFICIENCY MEASUREMENT: CASE OF SUMMER 2006 IN ELECTRICITY SALES BUSINESS IN POLAND

Abstract of paper

Decisions taken in order to achieve planned targets are always connected with risk that influences resources of the company – both in positive and negative way. It should be considered through capital perspective. That is why it is necessary to state that business decisions always have a financial character. It requires burdening it with costs of risk capital connected with each decision.

Hence, forming the risk capital – the insurance surplus of capital – should support the achieving the superior target of the enterprise: maximizing the long-term value of the company. This characteristic of risk implies the consequences of efficiency measurement. There is a necessity to extend the analyses of return on capital by taken risk. That is why risk profile should be considered and budgeted in the financial planning.

The lack of taking into consideration the risk in the process of management control and evaluation of management efficiency leads to the inefficient resources allocation in enterprise and reduction of information utility, which is provided to company's management. It can falsify the real picture of its financial situation. Therefore the financial analyses should be expanded by risk capital and unrealised results (unrealised PnL) even in the companies that are active on other than financial markets. The efficiency of the risk taken should be a basis for decisions of capital allocation and activities development.

The above-presented approach should be ground for integration of the risk management with overall economy of enterprises. It defines the target of the paper that is the searching of influence of risk (that took place during winter and summer 2006) on economics results of utilities selling power to final customers. There will be examined both expected and unexpected risk of retail portfolios including various options. One of the assumptions is that the enterprise activity should be presented as a set of portfolios with different risk profiles.

The authors believe that integration of financial sphere in enterprises with risk controlling techniques should make the process of management and efficiency control more consistent, installing the risk awareness into overall activity of the individuals taking decisions. Such a situation improves the steering their behaviours in the direction of maximizing the enterprise long-term value for all stakeholders.

1. Introduction

Risk Management is seen in many companies as an activity of small group of people that is isolated from core activity of enterprise – even as a kind of art having no influence on decisions of managers. It should be changed. However, until the moment, when risk management and risk controlling are an integral part of management process, these activities are a kind of an intellectual exercise of this staff the exercise without any influence on company activity. However, if we describe risk in below-presented way

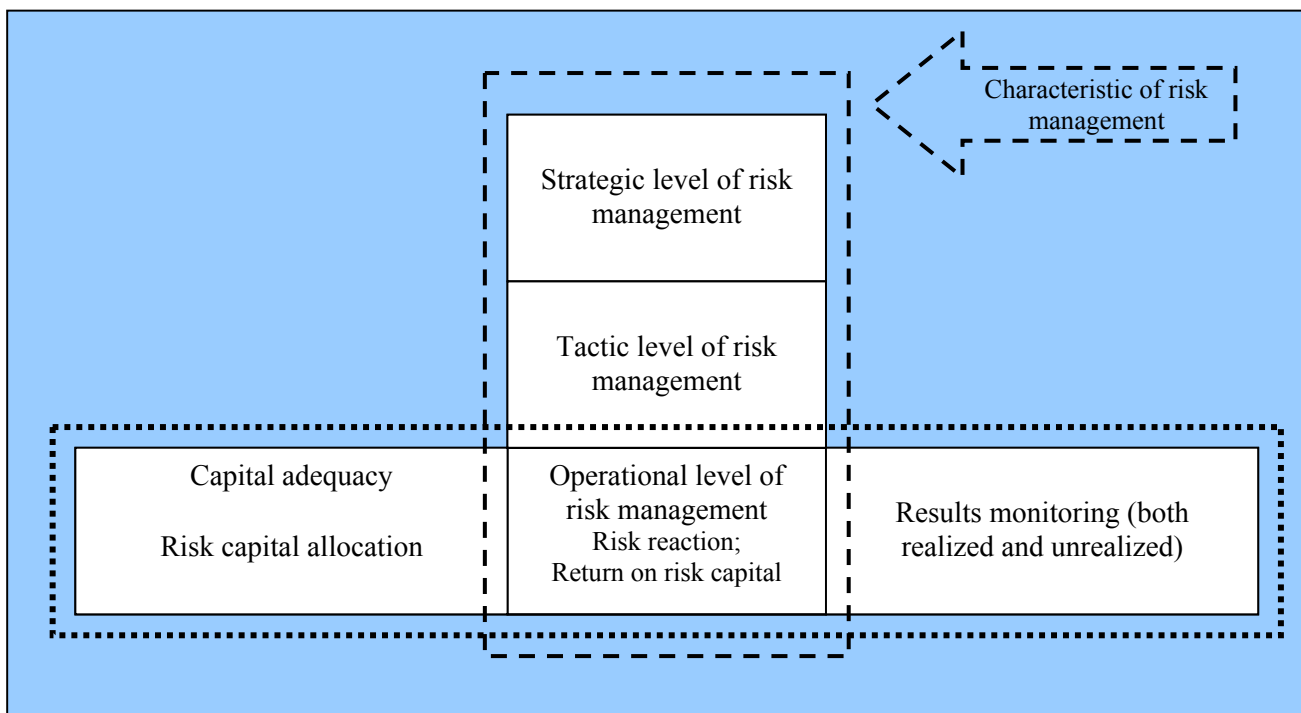
financial risk - in this paper - is defined as the value of unplanned change of companies capitals that is caused by discontinuity of trends determining the planned conditions of the company action. That is why risk should treat of value of capitals necessary to secure both the

results of company activity and continuity of its action, constituting the value that can be added or lost during the executions of company plans,

it should be considered as crucial item of overall economic results management.

Hence, only the integration of the risk controlling action with capital allocation and evaluation of decision effects allows motivating managers to achieve targets in the most efficient way from resources usage perspective.

Chart 1. Comparison of risk management and risk controlling areas in a enterprise



Source: own study.

Efficient management of risk influence on company's economic results is based on global analysis of business processes and identification of risk connected with these processes. It should be a basis to create the business model of the company. It should cover all elements of the results volatility, enable the efficient risk measurement, involve capital allocation and report risk adjusted results in various analytical dimensions.

2. Risk controlling in the company. Structure and function

Task of risk controlling in the organization is to departure from treating risk only from perspective of a threat and a necessity to secure against it. It is necessary to start the efficient management of risk taking, including in this process all the factors potentially leading to both losses and extra profits.

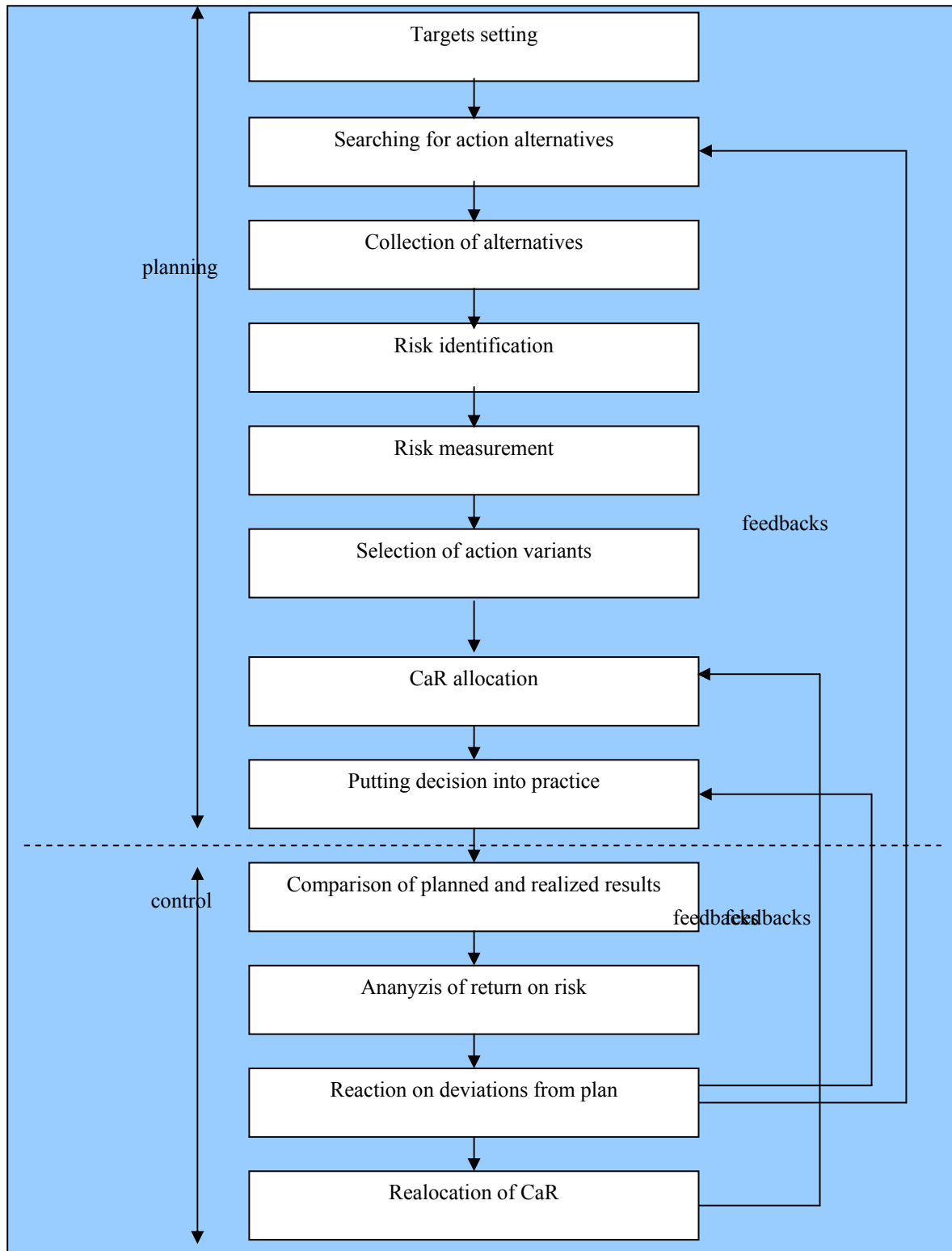
Risk controlling is, in this perspective, the over-functional system of steering the stability of expected economic result execution - having the cybernetic characteristics making it possible to implement to the all kinds of economic activity.

This situation determines the final structure of risk controlling as:

- capital adequacy and correctness of risk capital (CaR) allocation to the responsibility centers, what reflects in the risk taking limitation strategy;

- risk monitoring and steering risk exposure level that should be correlated with indications concerning the expected level of profit/risk relation;
- results monitoring – both realized and their projections (risk adjusted).

Chart 2. General presentation of decision taking process, planning and results control in the risky environment



Source: own study.

Hence it can be assumed that the efficient decisions are those, which allow to maximize the expected level of return on invested capital (including CaR) by taking the acceptable risk. The most efficient decision, within the group of alternatives characterized by the same risk value, secures the highest return. The set of such decisions should guarantee the lowest risk level by given return rate.

Future risk depends on actions taken today, while decision should be considered in the perspective of current risks. Optimal decisions will be taken when we couple the individual's subjective approach to risk taking and objective guidelines of risk instructions. On the basis of their assumptions, there is a measurement allowing for prioritization of alternatives for risk taking (decisions) from economic results perspective. It should allow making sustainable the creation of added value creation in the company. However, it should not create the obstacles for risk taking – on the contrary, there should be built the balance between risk aversion and taking advantage of opportunities.

Topics form area of risk controlling that should be solved by management control

- Each decision is connected with risk taking. Therefore the risk underestimation in management control and efficiency evaluation of managers leads to the ineffective capital allocation in the organization and reduction of the utility of the management information system. Moreover, not taking into consideration risk during results settlement can falsify the picture of real customers and products profitability and even the company's financial situation.
 - Risk should be considered in the perspective of company's capitals that are the superior source of financing its activity. Such approach has the fundamental implications for the analyzing of the decisions efficiency – is should also consider the CaR. That is why risk should be budgeted during the financial planning.
 - As it was previously mentioned, each decision is burdened with risks that influence the resources of company. That is why both decisions and risk should obtain the financial characteristic – each economic activity should be burdened with costs of specific risk capital.
 - The proper creation of efficient measurement that considers risk, streamlines the attitude to risk taking and maximizes the decisions efficiency. It denotes maximizing the economic profits by given costs, minimizing the costs in relation to given profits, maximizing the economic profits by minimizing the risk exposure. Hence, if the risk becomes the non-welcome variable, risk should be considered as a factor lowering the efficiency. If the mentioned approach is introduced, managers obtain the useful information concerning the whole picture of results, considering both realized and unrealized results. They - based on the obtained information and frames of risk tolerance - should aim to increase the area of secured results and to limit the area of uncertain profits.
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The risk measurement should be treated by management control process as part of the financial planning process influencing the definition of demand for risk capital, while CaR allocation defines the frames for risk taking. It should be the basis for measurement of value added created in the company.

3. Evolution of risk management on power market

Risk management should influence the whole activity of utilities on competitive power market: volatility of both prices and volumes, limited market liquidity (comparing to financial markets), credit risk, instability of legislation and regulations, operations mistakes. Hence, the significant evolution of risk management in electric utilities is visible. Not long ago, it was considered only from the perspective of risk modeling and market analyzing. – during this period the risk complexity concerned only market and credit risk factors.

Next, the risk management influence - following IAS 39 regulations - was expanded on the accountancy. After entrance into life the MiFID Directive¹ the new dimension of regulatory exposure was also created

The importance of risk management efficiency in the power industry is created by characteristic of risk profile that is a product of many specific factors (only for power market), affecting each other. Combination of prices seasonality, its jumps, instability of environmental regulations, changes in the intensity of demand and supply side (e.g. weather conditions, fixed assets quality in power plants and transmissions companies, fuel prices etc.) causes the significant difficulties in the risk analysis. It is of great importance for the whole activity of company. The mistakes done in the market and risk modeling can be reflected in the faulty decisions regarding investments and hedging or opportunities utilization. Moreover, the disturbances of the market mechanism lead to the different price levels than predicted based on the market models. It requires to consider the possible inaccuracies in the modeling. The risk controllers should be ready to give the hints to decisions concerning the risk reaction. Reaction to risk should ensure both the minimizing of unexpected losses and securing the utilization of market opportunities.

4. Analysis of the retail portfolio of Polish utility

Main risks for the retail portfolio of the power utility are the unexpected price and demand changes. Risk factors are: uncertainty of weather conditions, future demand, technology changes or new competitors.

Authors in this paper concentrate on the analysis of the risk of tariff customers demand changes that results from weather conditions. It was defined as profile risk. It is product of variation incorporated into sales tariff (swing option) – sales tariff transfers this risk to suppliers' portfolio.

The change of power consumption can be connected with the change of the purchase profile (for example: limitation of the consumption during cheap hours and increase of demand in the peak hours), which in the situation of the swing option and executed hedging can significantly change the expected margin. Demand changes can cause the significant price fluctuations, which can negatively influence the results of companies closing open position.

From this perspective it is useful to perceive the expected result as desirable value and risk, defined by one of the measures (variation, deviation, VaR, PaR etc.) as an unwelcome effect. The higher risk, the less probably it is to achieve the planned or expected value. The volatility emerges together with something unexpected. Hence, risk can be considered in the financial planning as an element of costs that is undesirable – it should be treated as decreasing the portfolio efficiency. In this situation it is desired to maximize the welcome values that are expected profits: the rule should be to maximize the potential, expected results and to minimize the exposure to unexpected risks.

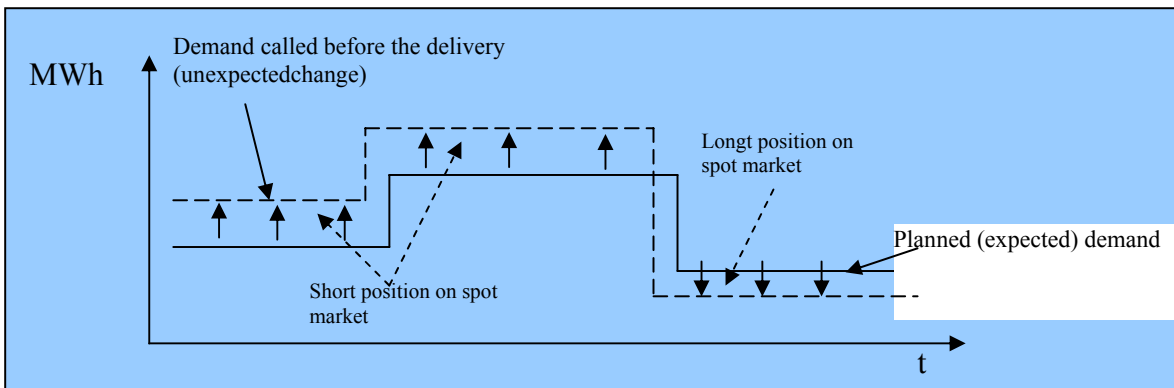
The above presented approach permits rationalizing the retail portfolio management: some value drivers increase while other are reduced – it is important to correlate its volatility properly. It can be a basis to expand the area of secured results and minimize the unwelcome risk during hedging action (within the organization risk tolerance) – striving not to reduce the opportunities.

¹ Directive of the European Parliament and of the Council of 21 April 2004 on markets in financial Instruments amending Council Directive 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC, DzUrz UE L 145, z 30.04.2004 r.

4.1 Profile risk in hedging of retail portfolio position's hedging

Power supplier, if it leaves the swing optionality in the sales contract, is exposed to the demand changes just before delivery (it should be adjusted on the suppliers' costs). This risk – profile risk – is inseparably connected with hourly changes of demand. It is product of volatility of spot prices and power consumption, because it is correlated with necessity to close the unexpected open position.

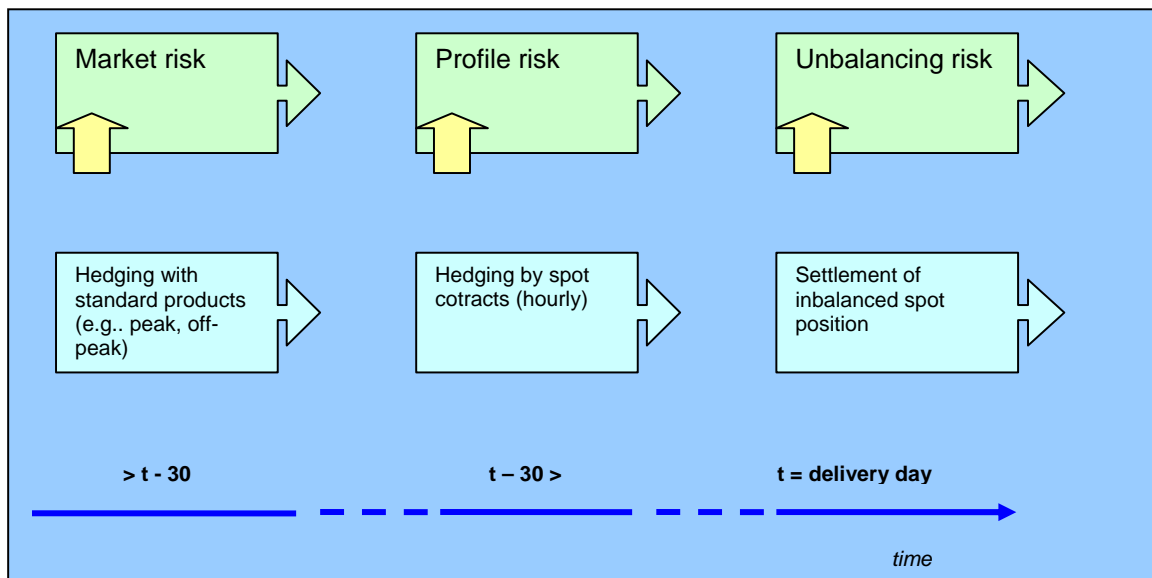
Chart 3. Hedging by closing long and short position



Source: own study.

Power supplier is forced to close the unplanned position by extra purchase of power (it can significantly change the costs), or sell the power surplus (risk to sell cheaper than hedging price). Position adjustment takes place on OTC or exchange market by concluding the hourly contracts.

Chart 4. Risk connected with hedging the result of retail portfolio



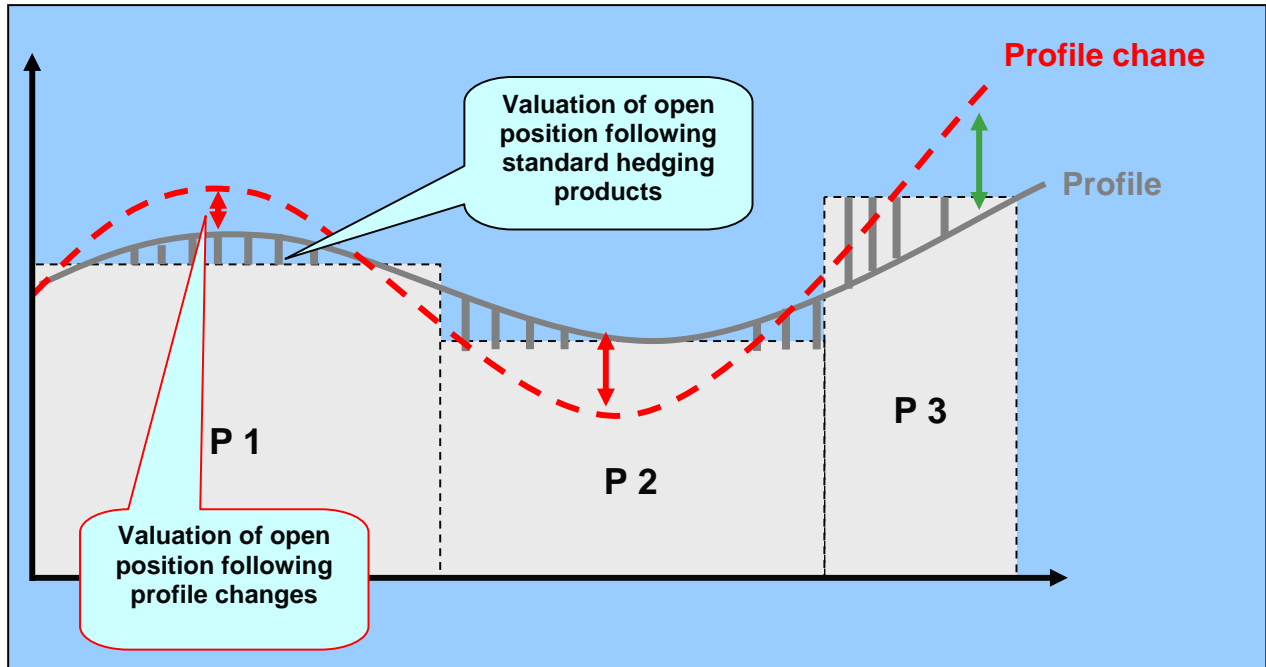
where:

t – time to delivery

Source: own study.

Position adjustment is usually possible to day before the delivery (t-1). Imbalanced positions are closed mechanically during delivery day - day (time "t") - by transmission system operator and are connected with significant losses.

Chart 5. General philosophy of profile risk analysis



Source: own study.

Profile risk relates thus to the position on spot market. The profile changes can be the source of extreme prices movements on the spot market. Its result is the necessity to consider in the risk modeling the changes of risk factors much above standard values.

4.2 Determination of the risk capital for retail portfolio

Value of portfolio risk should be divided into three elements: expected risk, unexpected risk, risk of extreme situation. Global risk value should be evaluated using the Monte Carlo simulation of potential changes of both volumes and prices.

Expected risk

Expected risk consists of the awaited costs of operating activity. It can be valued on following approaches:

- expected value of risk distribution;
- expected value of assessed risk based on historical data;
- assessed value based on experts' evaluation (plans).

Risk expected value treated as operational cost influences the PnL statement (costs) and balance sheet of the company (resources necessary for financing this costs). Value of capital necessary for this risk hedging - CaR_E - is included in the investment capital (IC), necessary to found the company's operational activity.

Unexpected risk

It should be considered as difference between risk value for particular level of confidence and expected risk.

$$R_U = R_\alpha - R_E$$

Where:

R_U – non hedged value of unexpected risk;

R_α – risk for particular quintile of risk distribution;

R_E – value of expected risk;

Unexpected risk is the value that can potentially reduce the economic result. It is necessary to secure its impact on the company's results by increase of the capital productivity. It is necessary to form the risk capital (CaR) in the value that by given return could cover the unexpected loss on non-hedged position.

$$R_U = CaR_{UR} \times RoCaR_U$$

Where:

R_U – non hedged value of unexpected risk;

CaR_U – capital formed to found R_U ;

$RoCaR_U$ – return on CaR_U .

Hence the value of CaR_U should be determined following:

$$CaR_U = \frac{R_U}{RoCaR_U}$$

CaR affects the whole liabilities structure or by the capital costs on the economic results of the company. There can be used risk capital being the limit of exposure for purposes of CaR demand determination. Then CaR in this situation is replaced by value of limit – CaRL, determining the maximum risk exposure: it should be assumed that CaRL constitutes the maximum level of risk that can be taken by responsibility center.

Risk of extreme situation

Risk of extreme situation is determined by defining the probable catastrophic situation for the company's results that can lead to problems with financial liquidity. It is crucial to form some risk capital dedicated to secure the continuity of company functioning (CaR_{ST}), even in the very dramatic market conditions. The demand for CaR_{ST} is determined as difference between R_{ST} and R_α - hence $CaR_{ST} = R_{ST} - R_\alpha$.

Since CaR_{ST} should support the survival of the organization even in the most unfavorable conditions, it should be treated as the important indicator of the company capital adequacy.

4.3 Risk capital founded in the external entities

CaR_U and CaR_{ST} can be formed directly in the companies liabilities, or it can be purchased as the service – risk capital outsourcing and formed in the liabilities of external entities. There should be always considered the possibility of capital outsourcing during analyzing the capital adequacy. It allows for limiting the risk capital formed directly in the company's liabilities, but not capital costs. Such service also costs. Therefore you should analyze the total capital cost including cost of CaR outsourcing to decide, which option is more profitable for the economic results – form whole risk capital directly in the liabilities or transfer part of this value on the third party guaranteeing the access to very liquid funds to the company.

The impact of outsourced risk capital on the financial results is the same as forming it in the company's funds. In order to increase the transparency of analysis of funds' sources financing the activity of company it is necessary to identify the CaR costs and allocate it to the risk centers creating it. Example of sources of such costs can be letter of credit or insurance.

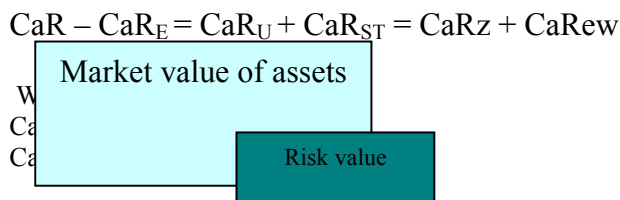
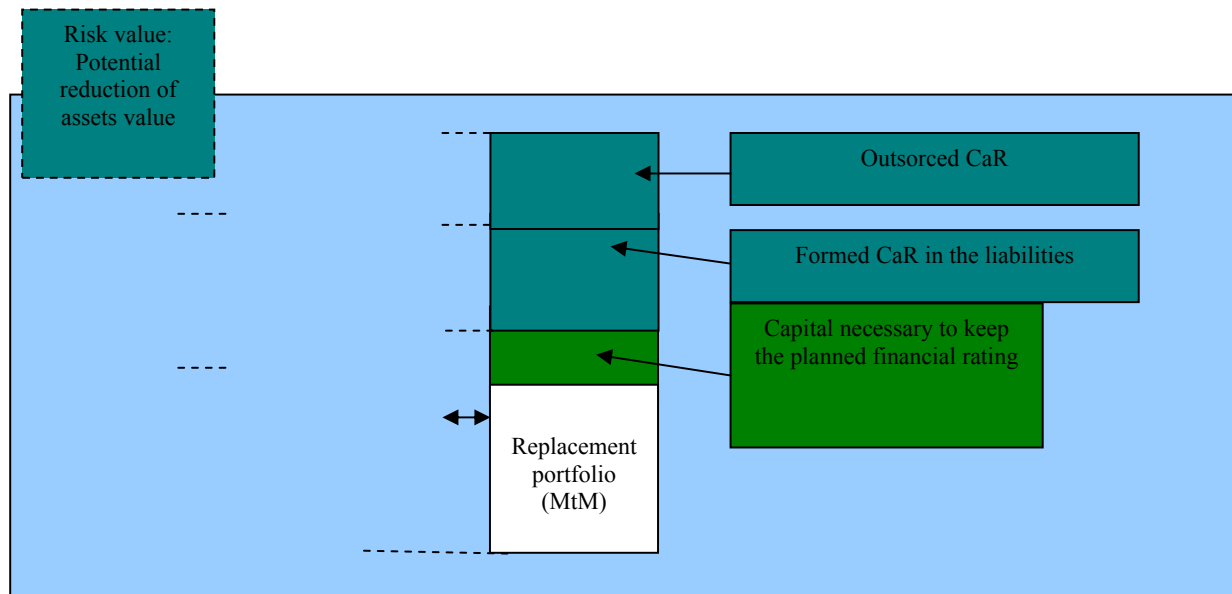


Chart 6. Capital structure considered from the perspective of global demand for the funds



Retained risk should be cover by increase of CaR, transferred risk should be reflected in the outsourced CaR.

Source: own study.

The above presented approach requires using the total average capital cost (TACC) in place of the weighted average capital cost (WACC). The approach, striving to consider the cost of risk transfer also as capital costs, allows to reflect real CaR costs it in the economic results calculations. Thus outsourced CaR should be considered in the financial analysis in the same perspective as founded capital in the liabilities.

CaR allocation to the particular responsibility centers should match the elements of global risk capital in the company:

- 1) formed CaR_z – following the risk exposure of responsibility centre;
 - 2) outsourced CaR_{ew} – following costs of risk transfer.
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The structure of global risk capital should match the global risk profile of the company and of particular responsibility centers – it should be a TACC analyzed during the research of company's capital adequacy. Similar, the definition of return of capital should base on the TACC requirements and total value of CaR demand..

4.4 Risk adjusted performance measurement

Each manager should be accounted for decisions efficiency taken in the conditions of risk (within the mandate frames) having impact on results of the responsible center. As mentioned before, only connecting the combination of the results of decisions efficiency measurement with motivation system allows risk controlling to have the real influence on the decisions-takers behaviors.

Monitoring the real financial situation requires the measurement and reporting of the whole economic results (PnL) of responsibility centre. Hence, it should be defined as the sum of the realized and unrealized results (future PnL), where:

- *realized PnL* (PnL_E) – executed result on the executed transactions and settled financial contracts;
- *unrealized PnL* (PnL_N) – measured future result of the company activity being the result of the changes in the fair value of the future, high probable transactions on the reporting date.

Authors propose to use for the analyzed portfolio and reporting period the gross margin as the indicator of the PnL:

- PnL_E constitutes the gross margin worked out until the reporting date (day n);
- PnL_N – constitutes the result on the open position and is based on two elements:
 - 1) PnL_{NH} – hedged margin: the part of portfolio that result is secured and 100% sure (not exposed on risk);
 - 2) PnL_{MtM} – result on the open position (unhedged) defined by mark-to-market.

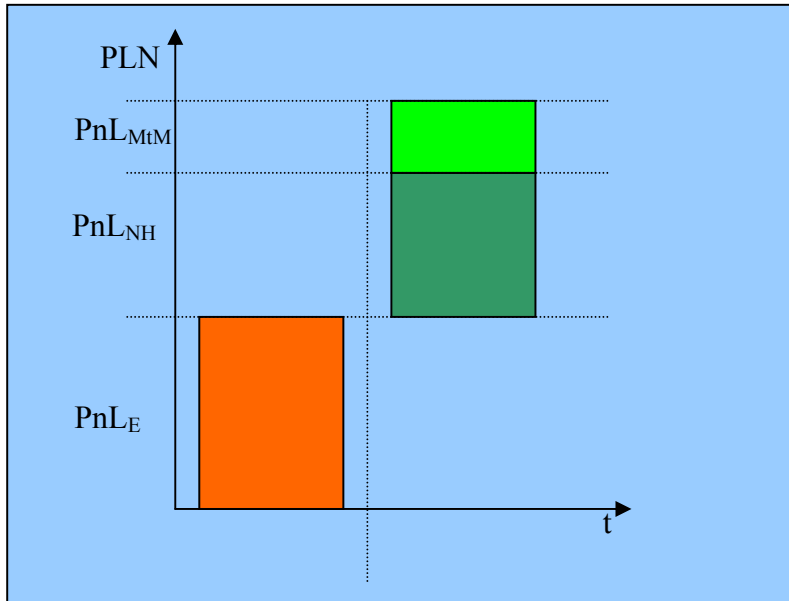
Hence:

$$PnL = PnL_E + (PnL_{NH} + PnL_{MtM}),$$

Where::

$$PnL_N = PnL_{NH} + PnL_{MtM}$$

Chart 7. Outlook of the analyzes of the portfolio results



Source: own study.

CaR influences company's costs. The efficiency analyses should be executed basing on the risk adjusted measures – presented below:

$$RoRaC = \frac{PnL}{IC + CaR_U}$$

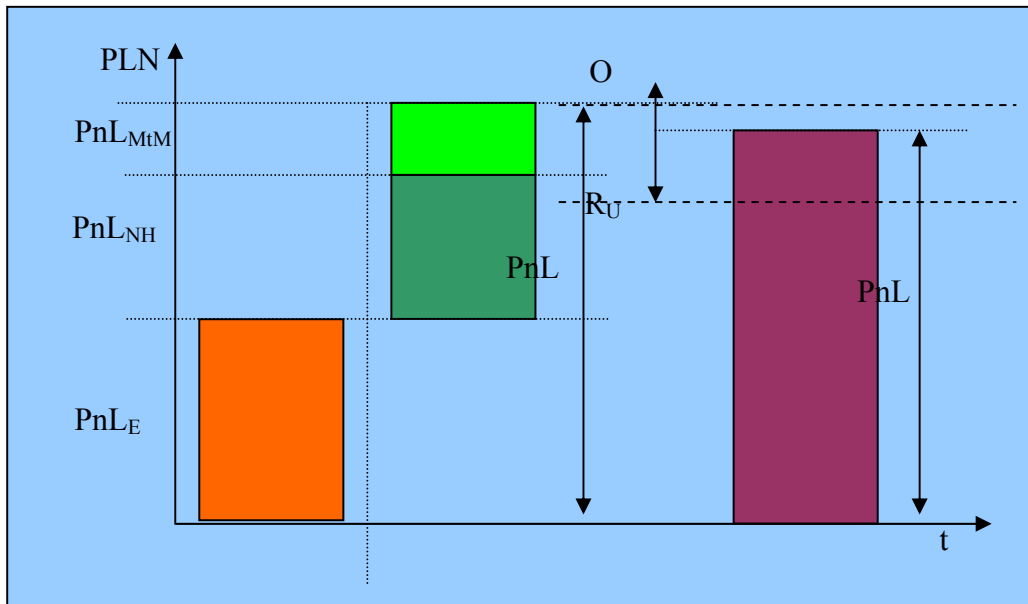
$$RoRaC = \frac{PnL_E + PnL_{NH} + PnL_H}{IC + CaR_U}$$

RoRaC should be higher than TACC (the required return on capital in the company). RoRaC should be treated as following:

- as the steering ratio within the reporting period;
- as the result after settlement period closing (end of deliveries, contracts' settlement).

First function should be more important for the supporting the achieving the company's target – this function allows monitoring of the possibilities of targets reaching by particular part of the company. Analysis of RoRaC gives the possibility to adjust the strategy of economic results hedging.

Chart 8. General philosophy of analyzing the possibilities of reaching planned results



where:

O – opportunities;

PnL_T – planned PnL (target).

Source: own study.

It is crucial to place the value of PnL in the area of $[(PnL_T - R_U) \text{ to } (PnL_T + O)]$. If PnL is lower than minimum of the expected range there is necessity to adjust the position in such a way to achieve the expected range.

4.5 Analysis of risk influence on the economics results of retail portfolio in hypothetical utility

Risk of the retail portfolio was analyzed for two months in year 2006 – January, July. These months were characterized by significant deviations from average temperatures characteristic for this period. Hence this periods can be basis for research both for risk analysis and efficiency of potential hedging products. Target of hedging is to secure the planned gross margin.

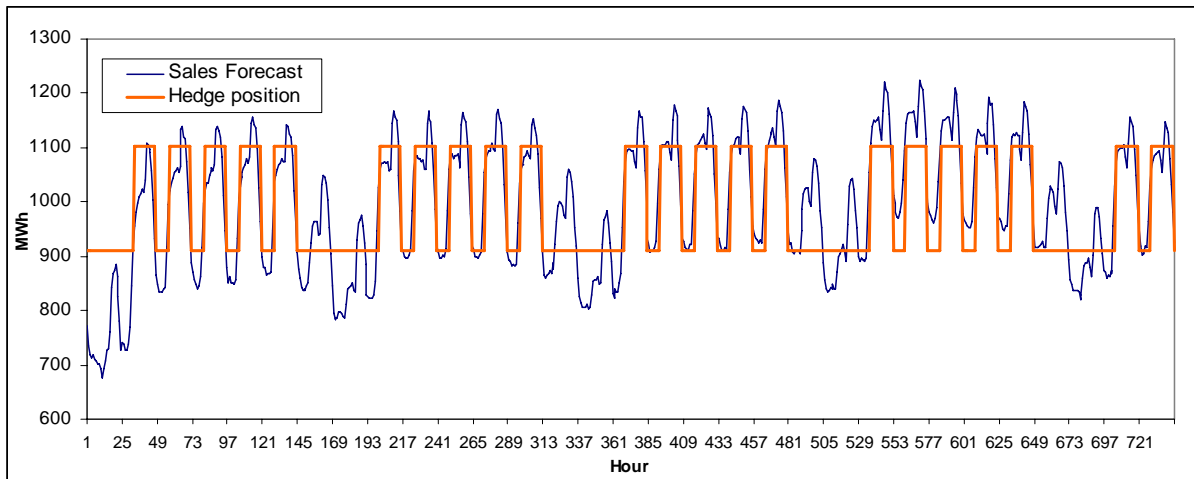
Changes of the power consumption and load of analyzed portfolio were determined on changes of demand in Polish power system in the analyzed period. It gives the research the characteristics of universality and allows for drawing conclusions useful for the whole country.

The sales position of the analyzed portfolio was hedged by standard hedge contracts purchased on the OTC. The hedging strategy is Delta Hedge – sum of open positions value aims at zero. The hedging is executed by concluding the typical block contracts – baseload, peakload, off-peak.

4.5.1 Analysis of retail portfolios risk in January 2006

Applying the Delta Hedge strategy allowed to secure the planned sales position in January 2006 by typical standard products – peakload and off-peak.

Chart 9. January 2006 – planned sales position and hedge position



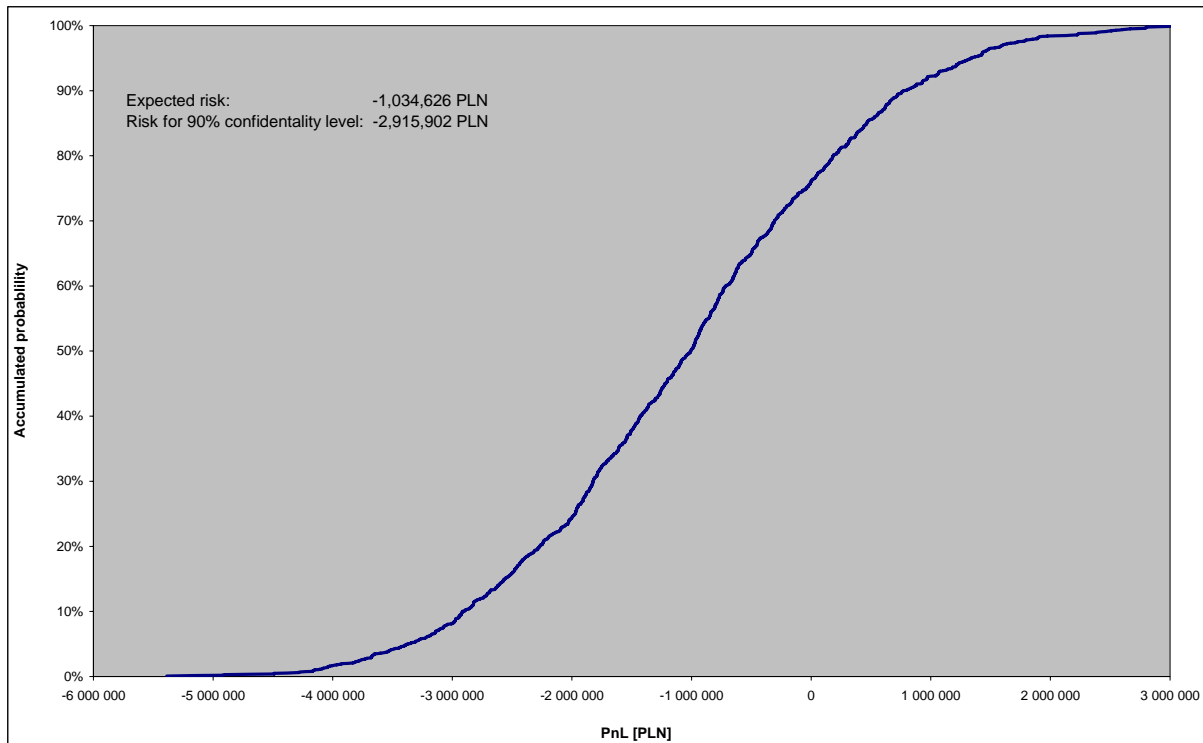
Source: own study.

The planned sales position changes, if there is possibility to execute by customers the swing option following the changeable weather conditions. Hence it is necessary to consider the pricing techniques based on options valuation for such portfolios.

Short term open position is closed on the day a-head market (spot) based on the values defined during the short term planning of sales (n-1) and can be significantly different from previously planned sales, which is the basis for hedge position – long term forecasting of the sales position and its volatility influences the strategy of hedging.

The above-described issues are the basis for risk valuation by Monte Carlo method of the hypothetical retail portfolio. This risk is the result of the change of the power consumption profile and necessity of securing the economic results of this portfolio against potential losses being the result of both potential power consumption changes and price volatility on spot market.

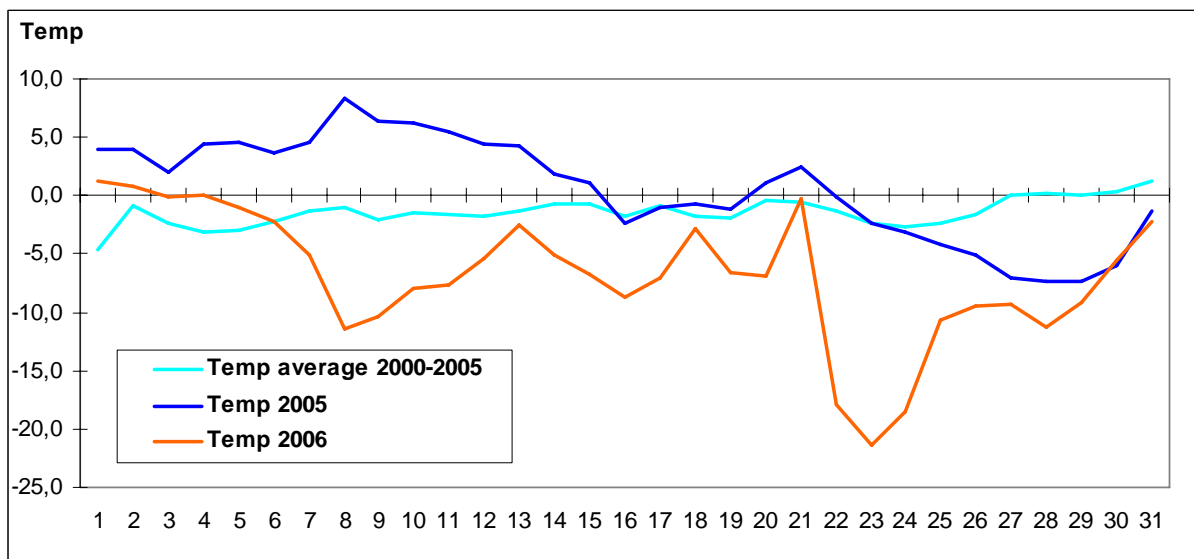
Chart 10. Risk distribution of the analyzed portfolio for January 2006



Source: own study.

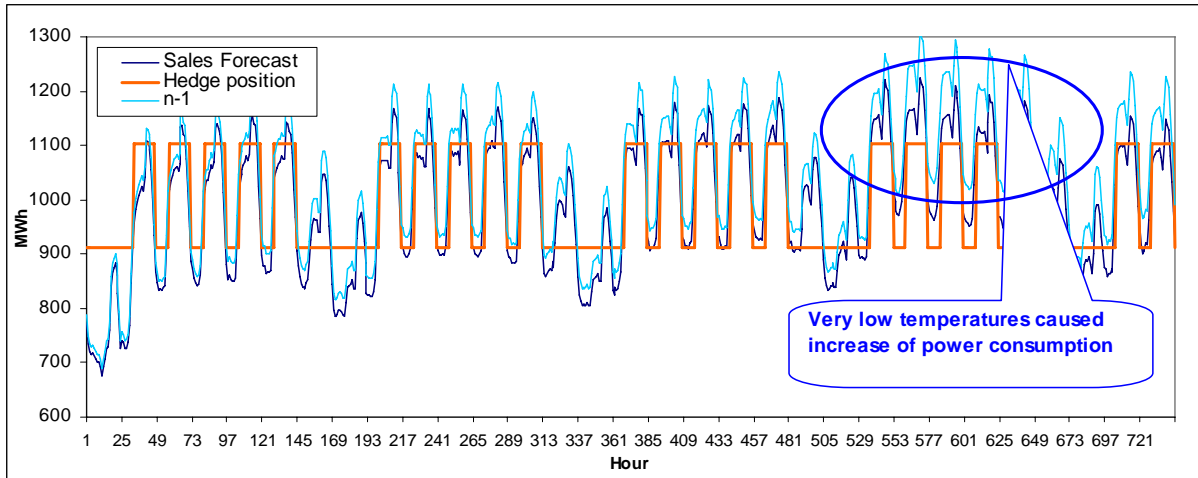
Significant temperature fluctuations were observed in January 2006, They differed significantly from average values. The wave of cold has increased consumption and influenced on the rise of spot prices, what was reflected in the gross margin of the portfolio. The power consumption deviation from planned values presents below chart.

Chart 11. Temperatures deviation in January 2006



Source: own study.

Chart 12. January 2006 – Sales deviation from long term forecast



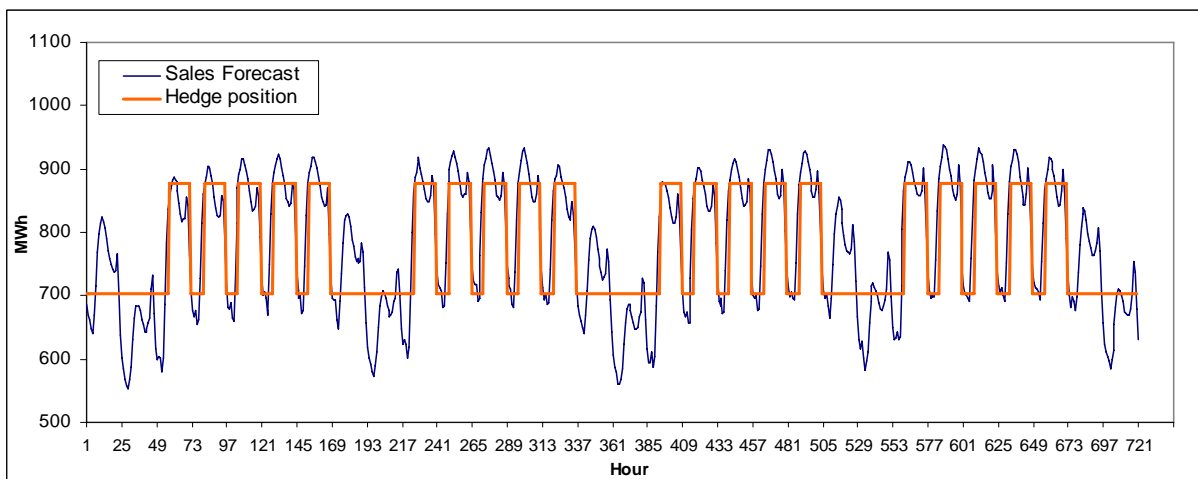
Source: own study.

Following the above presented uncertainties, risk was calculated using Monte Carlo techniques. It is to give the picture of possible losses form correlation of consumption and price changes.

4.5.2 Analyses of retail portfolio risk for July 2006

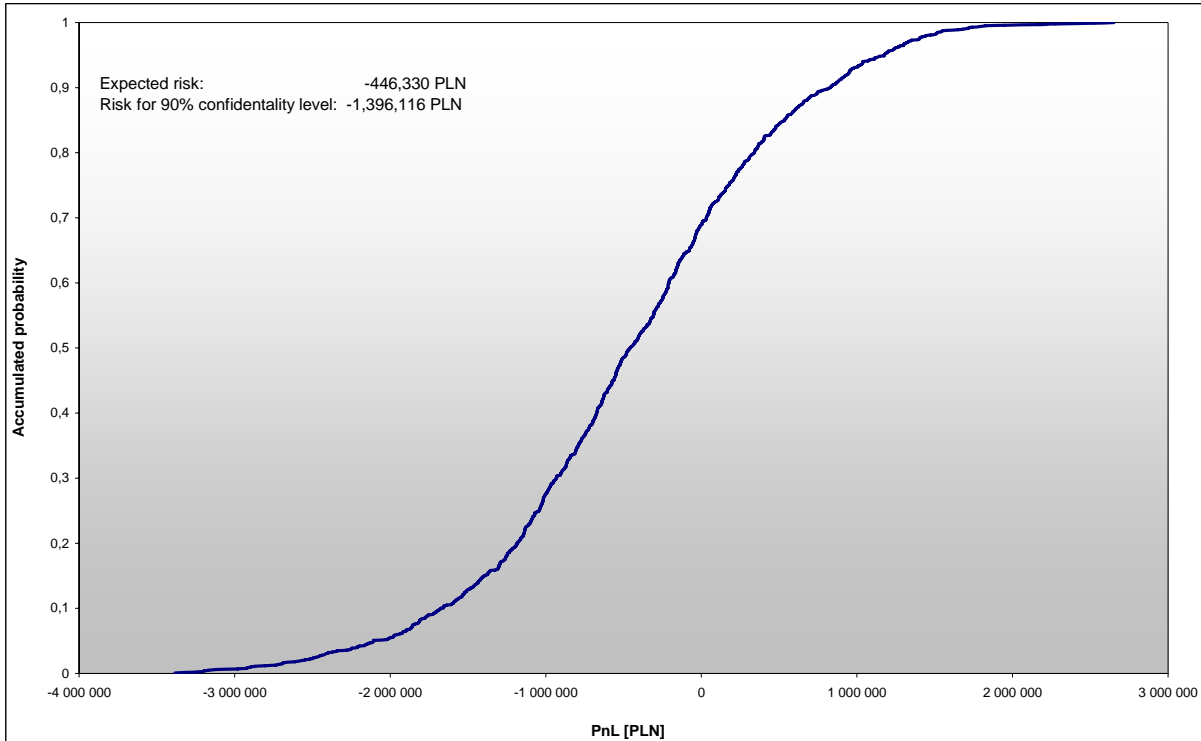
There was applied Delta Hedge hedging in July 2006 - the similar results securing strategy to January 2006 – that is presented below on the chart.

Chart 13. July 2006 – planned sales position and hedge position



Source: own study.

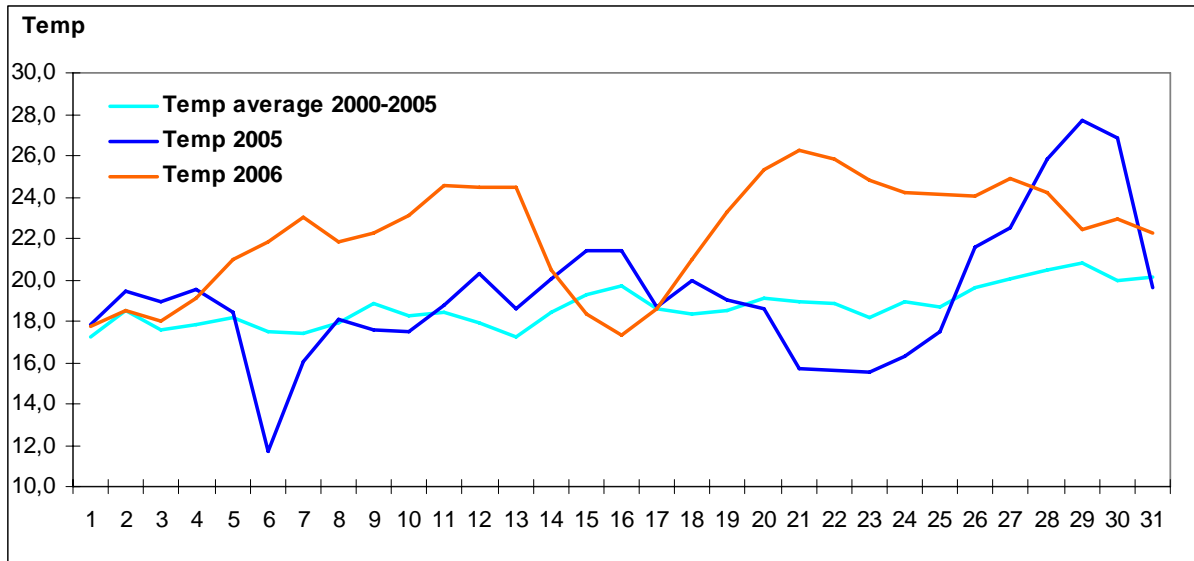
There was estimated risk for the retail portfolio based on Monte Carlo simulation. It is again the product of potential volumes fluctuation and spot prices volatility that influences on the results from unwelcome positions closing.

Chart 14. Risk distribution of the analyzed portfolio for July 2006

Source: own study.

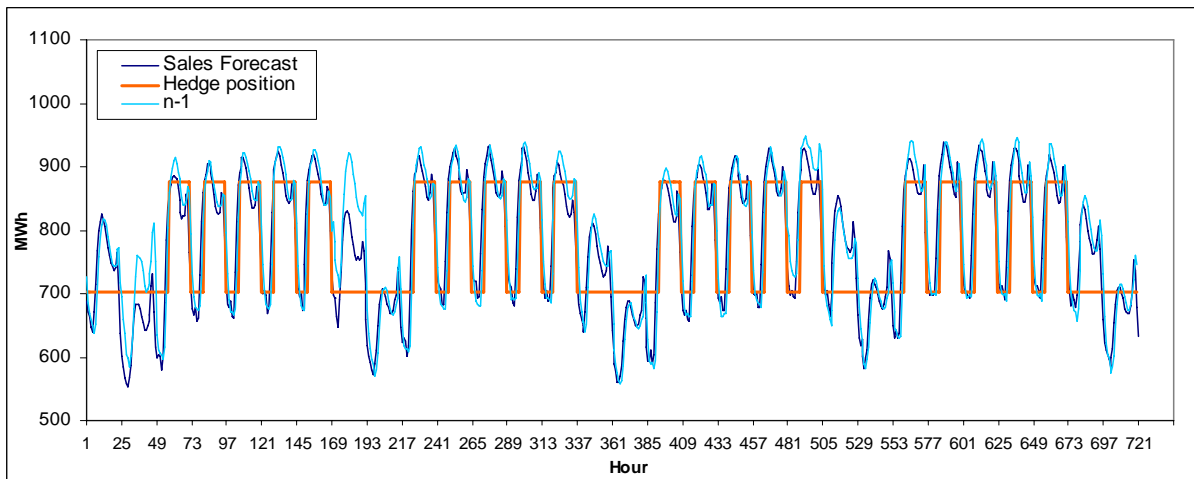
The average temperature in July 2006 was 22,3 °C and was in comparison to previous year about 3,1 °C higher. It deviated also significantly from five years average. There increased sharply the power consumption in Poland following this heat wave, because of high usage of cooling devices. The product was significant deviation of the short term forecast from long-term prediction of sales volumes. It caused the open position that had to be closed on the spot market.

Chart 15. Temperatures deviation in January 2006



Source: own study.

Chart 16. July 2006 – Sales deviation from long term forecast



Source: own study.

4.5.4 Analysis of hedging instruments of retail portfolio against profile risk caused by temperature uncertainty

The following instruments can be used for hedging unwelcome profile risk correlated with weather condition changes – weather derivatives:

- 1) call option;
- 2) swap.

Efficiency analysis of call option in January 2006

The long position in call option should at least theoretically hedge the gross margin of searched portfolio against unexpected weather changes.

Basic definitions for weather derivatives

HDD (heating degree days) is defined for particular day as difference between 18°C (hypothetical limit for heating and cooling season) and average temperature of this day. If the difference is negative the HDD is estimated on zero.

$$HDD = 18^{\circ}C - T_{EXEC},$$

CDD (cooling degree days) is defined as as difference between 18°C (hypothetical limit for heating and cooling season) and average temperature of this day. If the difference is negative the CDD is estimated on zero.

$$CDD = T_{EXEC} - 18^{\circ}C,$$

Average temperature is determined following below formula:

$$T = (T_{max} - T_{min}) / 2$$

Where:

T_{max} – maximal temperature within day and night,

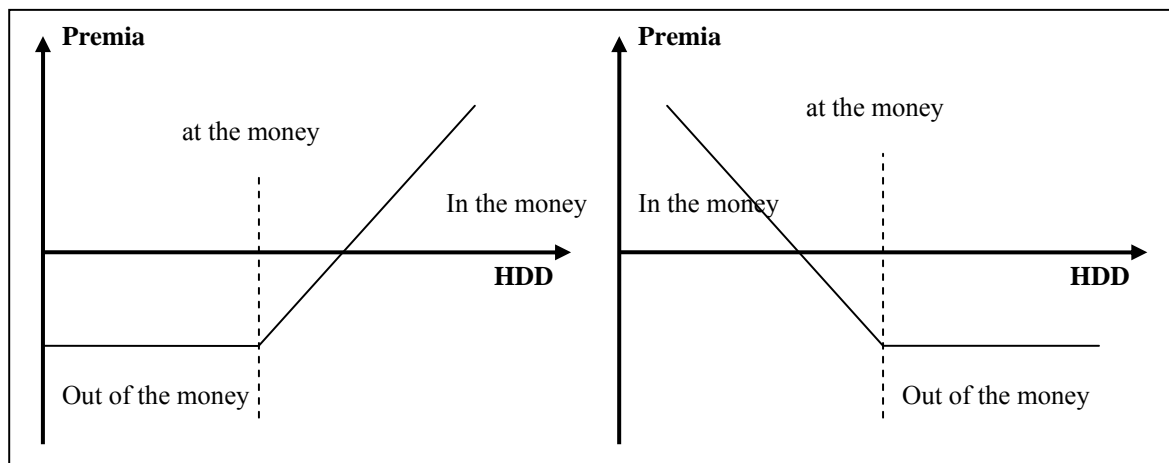
T_{min} – minimal temperature within day and night.

Weather derivatives hedging – call option

Assumption: Hedging secures the company against temperature changes.

Option on temperature – call/put – secures the buyer the pay off following the change of HDD, if the real temperature is lower (higher) than strike (defined as particular HDD). Tick is the pay off for each unit HDD change, when option is in the money.

Chart 17. Pay-off function of call option on temperature



Source: own study.

Maximal pay off is determined by below-presented formulas:

$$V_{call} = \min \{ \text{tick} * \max (0, HDD - \text{Strike}), H \}$$

$$V_{put} = \min \{ \text{tick} * \max (0, \text{Strike} - HDD), H \}$$

gdzie *tick* jest ceną za 1 HDD i *H* maksymalną wypłatą na którą zgodziły się strony kontraktu.

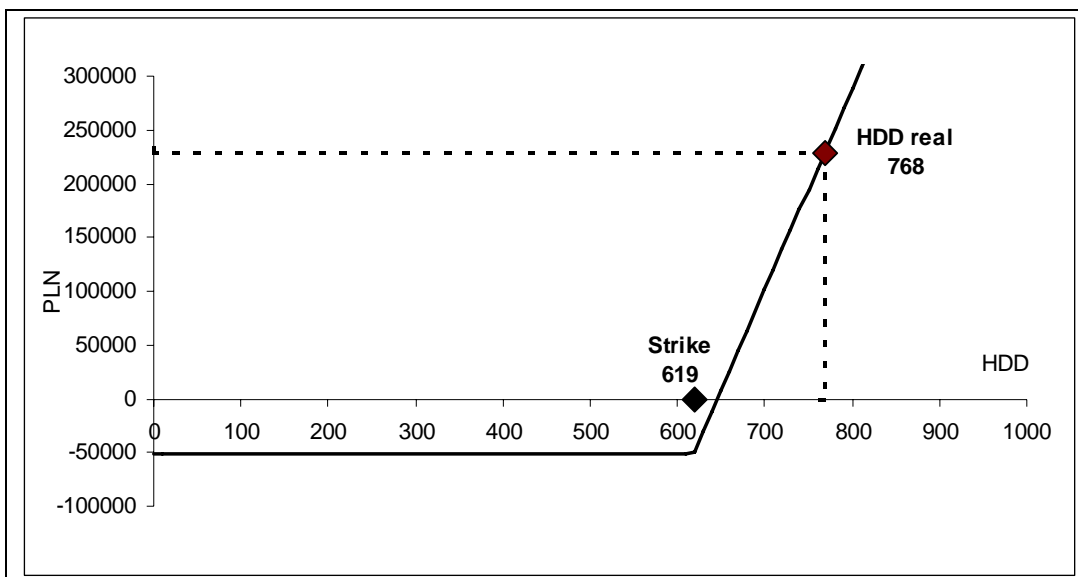
Assumptions to hedging strategy:

- monthly hedging instrument – long position;
- options parameters:
 - o Strike: 619 HDD (-2 °C)
 - o Tick: 1 880 PLN/HDD
 - o Premium: 51 280 PLN

As there was mentioned before, the winter in January 2006 was significantly frosty. Average temperature was about -6,7 °C, what is 768 HDD. It caused the sharp increase in power consumption by retail customers – increase in heating devices. Hence, there could be expected the significant volatility of prices on spot market.

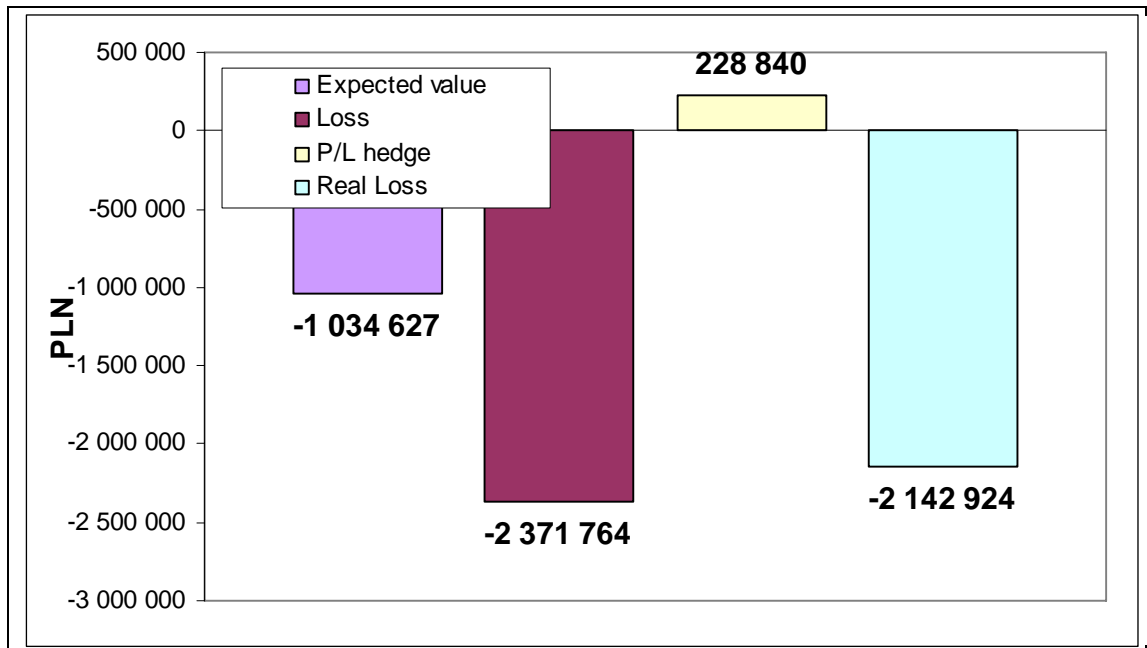
PnL in a function of HDD resulting from the use of call option and hedging results are presented in charts below.

Chart 18. PnL for analyzed call option in January 2006



Source: own study.

Chart 19. Hedging result by usage of call option in January 2006



Source: own study.

The application of call option after premium reduction gave profit of 228,840 PLN. It limited the loss of closing short spot position from -2,371,764 PLN to -2,142,924 PLN. The expected value of profile risk was -1,034,627 PLN – the result of correlation of price and volume volatility. On Polish market however, the price changes were not yet observed although they should be a consequence of a higher demand resulting from extremely cold days.

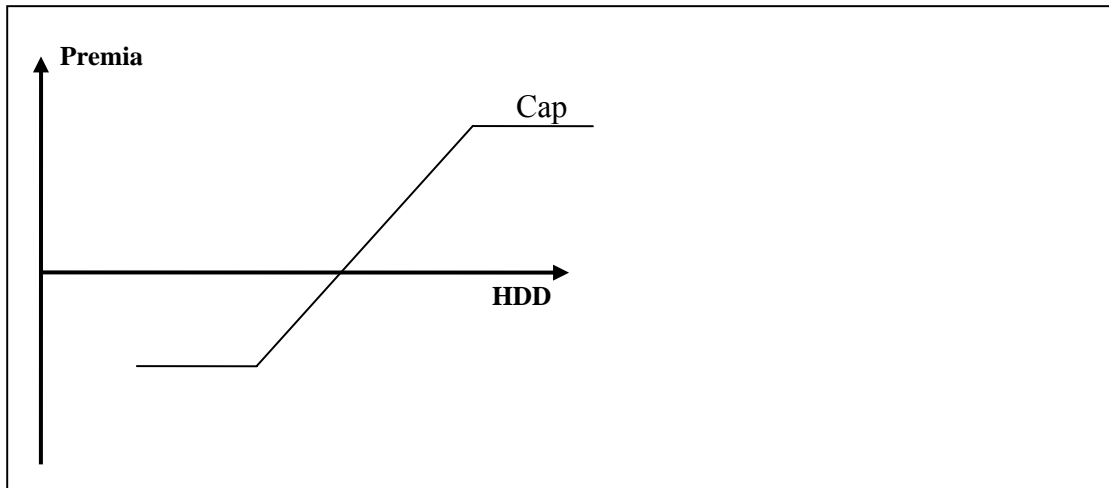
Efficiency analysis of swap in January 2006

Position long swap should hedge the gross margin against unexpected fluctuation of both price and volume.

Hedging with use of swap contract

Assumption: Hedging considers both temperatures and spot prices changes.

Chart 20. Pay-off function of swap contract



Source: own study.

Tailor made swap constitutes as some kind of vanilla swap, but the difference is that parties agreed to exchange particular volume of power by change of 1 HDD (replacing in the swap construction the money). The pay off depends on two variables – real HDD and spot price.

$$\text{Pay off} = \{ (\text{HDD} - \text{Strike}) * \text{tick} \} * (P_{\text{FIX}} - P_{\text{SPOT}})$$

Where:

P_{FIX} – guaranteed price for particular power unit defined by tick. It means in practice that by real HDD and executed strike the buyer will obtain the pay off following the difference between P_{FIX} and P_{SPOT} and agreed tick.

Above-presented instrument allows to hedge spot price (fixed price) of particular power volume (tick) caused by temperature changes (HDD).

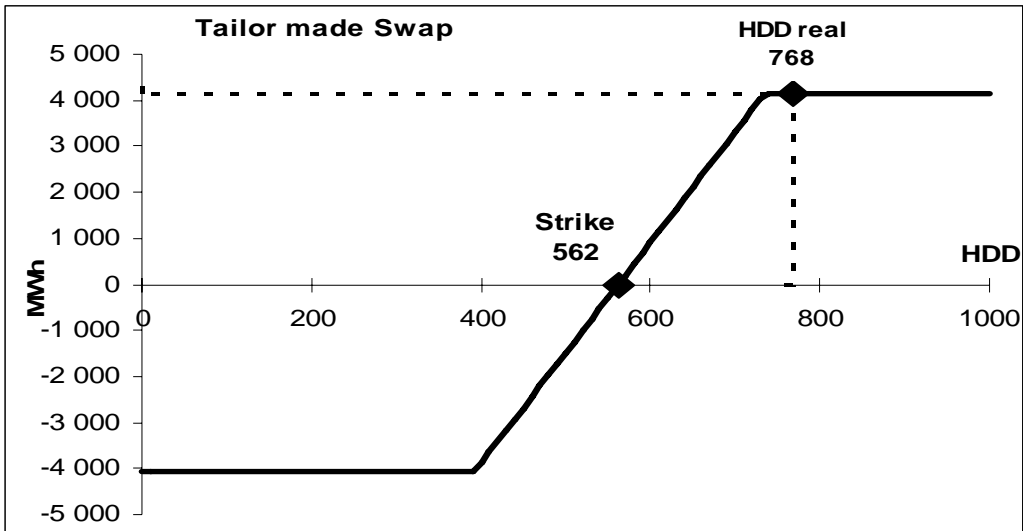
Hence, the application of hedging instrument, that is swap, enables also to secure the economic results against changes of prices on spot market.

Assumptions to hedging strategy:

- monthly hedging instrument – long position;
- swap parameters:
 - Strike: 562 HDD (-2 °C)
 - Tick: 24 MWh/HDD
 - Fixed Price: 114,60 PLN/MWh
 - Premia: unknow

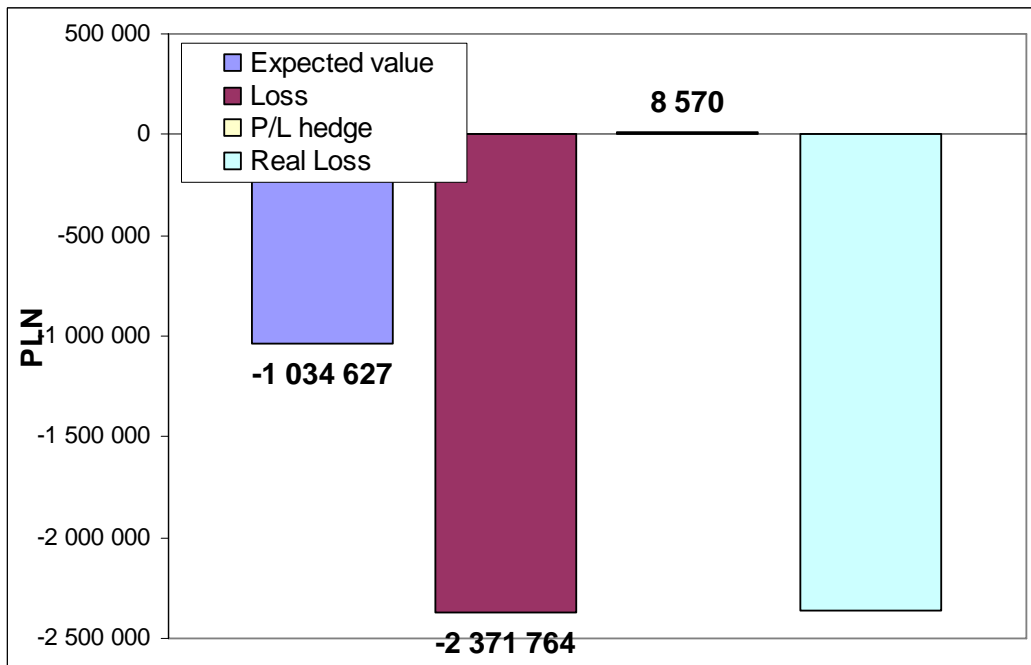
Spot price in January 2006 was 116,7 PLN/MWh. Deviation between executed and hedged price was $116,7 - 114,6 = 2,1$ PLN/MWh. Multiplying this value by tick gives PnL of 8,570 PLN (without premium reduction).

Chart 21. Analyzed swap pay off in January 2006



Source: own study.

Chart 22. Hedging result by usage of swap in January 2006



Source: own study.

The change of the prices on the spot market was limited. It influenced the PnL from its usage. Hence, this type of product could have limited efficiency on the immature power markets. The value of premium and tick is also unknown.

Simulation of higher price volatility resulting from increased power consumption presents the advantages of swap's usage to hedging purpose: increase of spot prices to 200 PLN/MWh and rise of price differences to 85,4 PLN/MWh and profit from hedging to 353,473 PLN reduced by premium. This product could hedge the real loss by securing the spot price on the level 114,60 PLN/MWh.

The simulation of different applications variants of the analyzed hedging products is reflected in the result of hedging efficiency. What is important, however, it is the alternatives' influence on the gross margin, which results from selling the energy to the final customers.

As it is clearly visible in the following table 1, the planned margin was 0,88 PLN/MWh, but the one realized without hedging, was lower by 0,18 PLN/MWh. However, there should always be taken into account that what influences the margin is not only higher cost (stemming from buying greater than planned on spot market, amount of energy) but also increased income from selling energy to final customers. Using call-option guaranteed the gross margin, but even influenced its improvement (pickup). Applying the exchange contract had no practical influence on margin pickup.

Table 1. Comparison of hedging results for researched portfolio in January 2006

Gross margin	January [PLN]	July [PLN/MWh]
Planned	634 959	0,88
Realized without hedging	518 458	0,70
Realized with hedging - Option	747 298	1,01
Realized with hedging - SWAP	527 028	0,71

Source: own study.

Efficiency analysis of call option in July 2006

The utility should have the possibility of hedging against the temperature spikes that cause the consumption jumps as a result of increasing usage of cooling devices. The example of this trend is summer 2006.

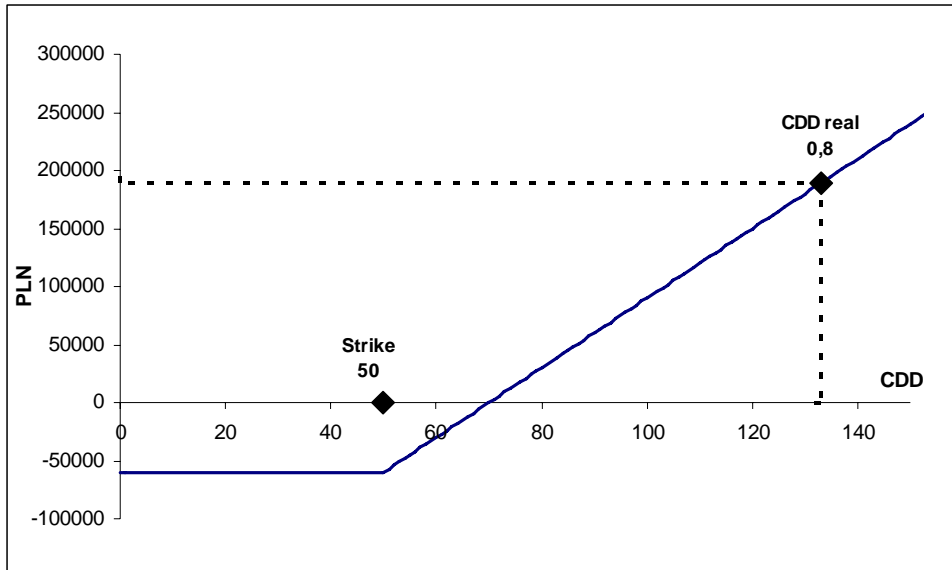
Option call was applied to hedging. HDD is replaced for the summer months by CDD.

Assumptions to hedging strategy:

- Strike: 50 CDD (19,6 °C)
- Tick: 3 000 PLN/CDD
- Premium: unknown

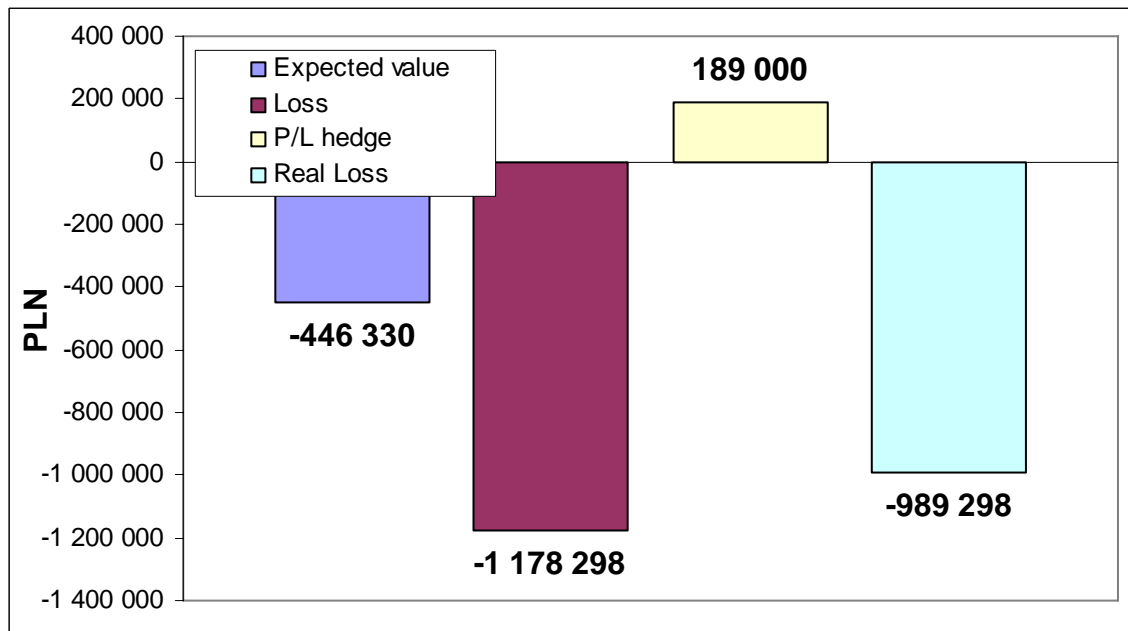
The hedging result is presented in below chart. CDD was in July 2006 133 (for 22,3°C). If parties would agreed following the assumptions for January 2006, the loss could be -989,298 PLN minus premium.

Chart 23. Analyzed call option pay off in July 2006



Source: own study.

Chart 24. Hedging result by usage of call option in July 2006



Source: own study.

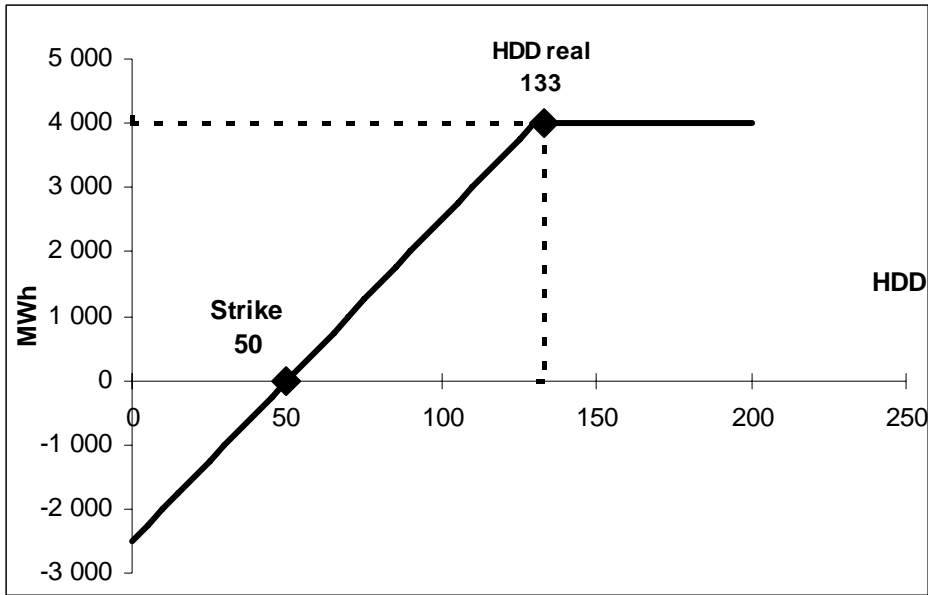
Efficiency analysis of swap in July 2006

Long position in weather derivative swap should at least theoretical secure the gross margin of searched portfolio against unexpected weather fluctuations.

Assumptions to hedging strategy:

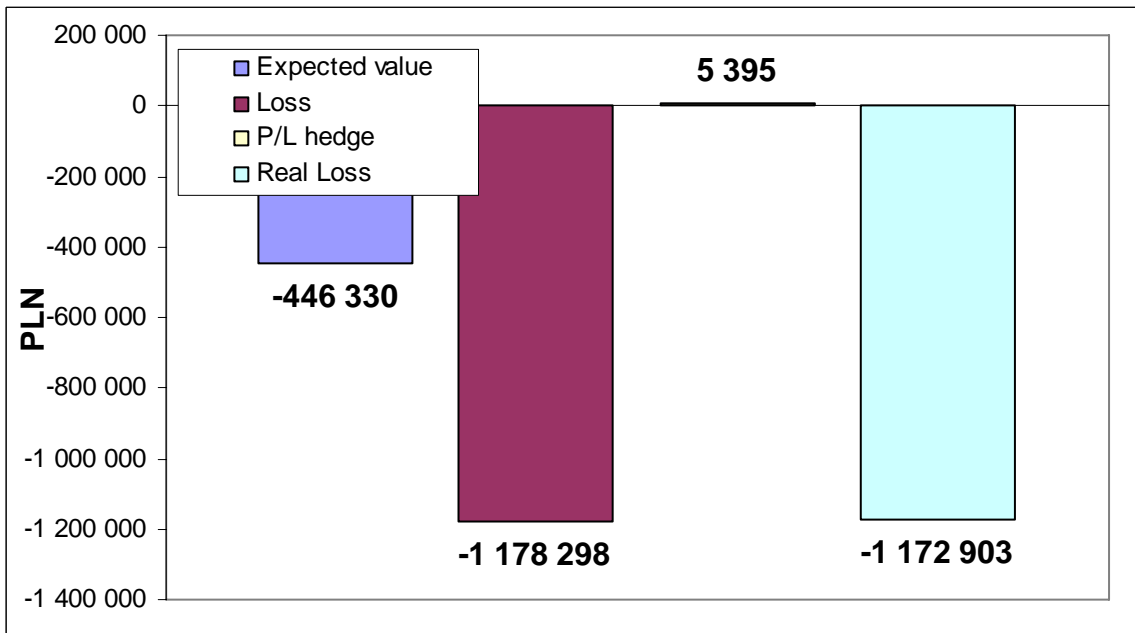
- Strike: 562 HDD (-2 °C)
- Tick: 100 MWh/HDD
- Fixed Price: 114,60 PLN/MWh
- Premium: unknown

Chart 25. Analyzed swap pay off in July 2006



Source: own study.

Chart 26. Hedging result by usage of swap in July 2006



Source: own study.

Similarly to swap hedging results in January 2006, swap in July 2006 was also not very effective from economic results hedging point of view. Swap usage application was not related to significant loss reduction, secondary to low correlation between spot price and temperatures changes. Additionally, the efficiency of this kind of hedging was reduced by political risk – the transmission system operator blocked power exportation in order to avoid potential black out, maximizing importation at the same time, what significantly reduced (in the conditions of supply surplus) the spot price level comparing to other European power markets.

Changes of gross margin, resulting from applying analyzed hedging products in July 2006 are presented in table 2. The planned margin was 1.12 PLN/MWh. Executed margin without using hedging was higher of about 0.03 PLN/MWh.

Applied products were to secure against changeability of spot prices, resulting from weather changes. However their low changeability had an influence on the improvement of planned outcome, in practice- on the more than planned increase of margin. For example, in the case of call-option to 1.48 PLN/MWh, and in SWAP to 1.16 PLN/MWh.

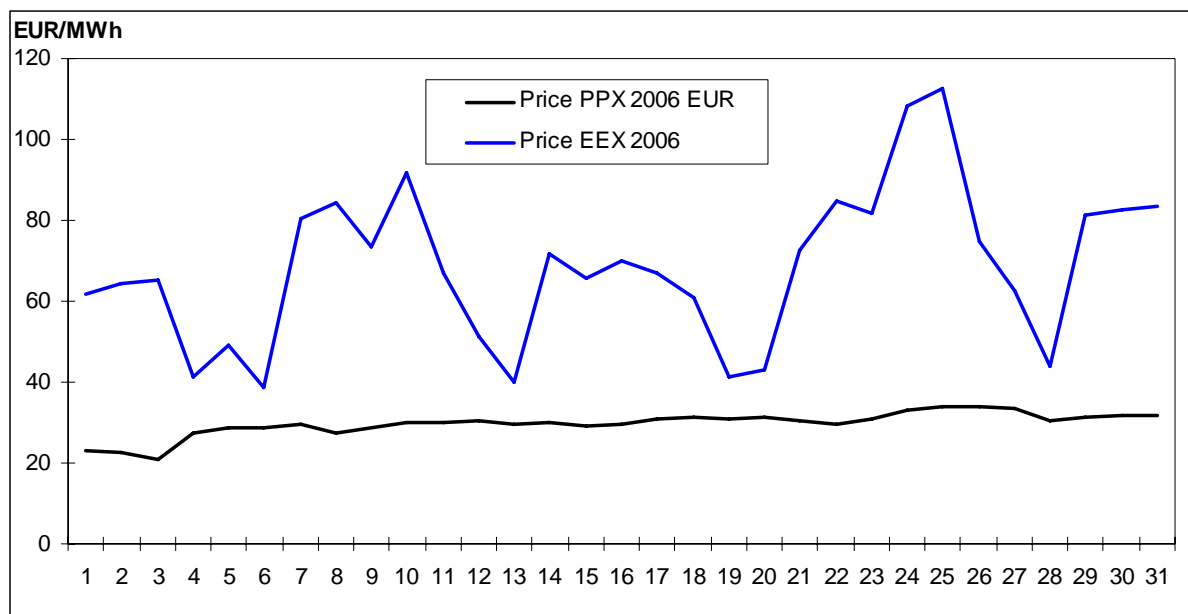
Table 2. Comparison of hedging results for researched portfolio in July 2006

Gross margin	January [PLN]	July [PLNMWh]
Planned	641 813	1,12
Realized without hedging	670 129	1,15
Realized with hedging - Option	859 129	1,48
Realized with hedging - SWAP	675 524	1,16

Source: own study.

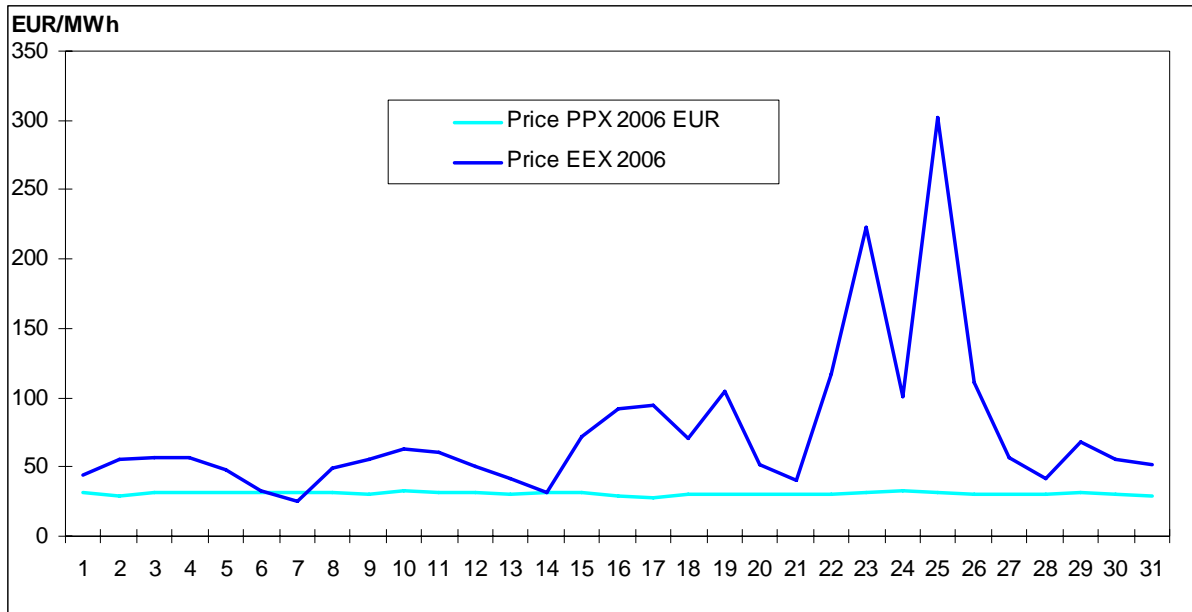
It is very important to signify that Polish energy market is in the development phase. That is why risk factors do not reflect the analogical changeability in extreme weather conditions to observed changes in developed European markets (i.e. in Germany). This situation was illustrated in the following pictures, which presents the spot prices (EUR/MWh) on PPX and EEX in January and July 2006.

Chart 27. SPOT price in January 2006



Source: own study.

Rysunek 1. SPOT price in July 2006



Source: own study.

The prices on PPX did not change, as it was expected for significant fluctuations of temperatures. However, on EEX, the prices were characterized by major fluctuations. One of the reasons for that kind of situation was the decisions of sending operator, who aiming to limit the risk of blackout, artificially steered the supply on Polish market (limiting the exchange between systems). It is political risk, which cannot be forgotten in the process of risk management, and especially on energy emerging markets.

Gross margin in this case would not mark the same values as for the examples of realized spot prices variations in that period on Polish market. Planned margin at the level of 0.88 PLN/MWh for similar dynamics of price changes on Polish market on the next day, to respective prices on German market, was a loss at the level of -0.26 PLN/MWh.

Owing to usage of the considered earlier hedging products (call-option and swap contract) the effects of extreme weather changes were significantly less expensive. If the call-option was applied to hedge, the investigated portfolio would mark profitable margin (0.05 PLN/MWh). Through usage of monthly product – SWAP - the loss would be decreased by 0.12 PLN/MWh)

Table 3. Comparison of hedging results for researched portfolio in January and July 2006 for simulated increase of prices volatility

Gross margin	January [PLN]	July [PLN/MWhj]
Planned	634 959	0,88
Realized without hedging	-188 634	-0,26
Realized with hedging - Option	40 206	0,05
Realized with hedging - SWAP	-105 900	-0,14

Source: own study.

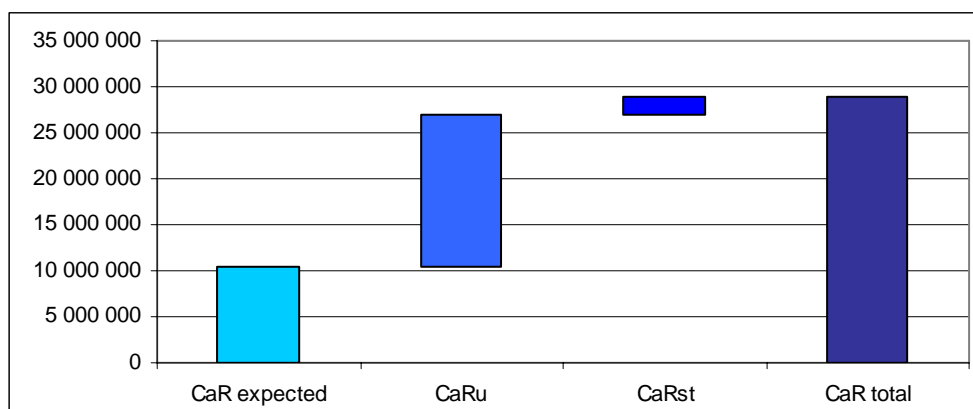
4.5.5 Analysis of return on risk adjusted capital for various hedging standards of retail portfolio – ex-ante approach for steering purposes

There were planned following gross margins on analyzed portfolios for researched period:

- January 2006: 634,958 PLN;
- July 2006 r.: 641,813 PLN

There was executed the analysis of both demand for CaR in the retail portfolio and return on risk adjusted capital for these months. RoRaC was considered as steering ratio. Below is presented the demand for CaR in January 2006 determined for analyzed portfolio – the hedging with call option is considered.

Chart 28. CaR demand of retail portfolio in January 2006 – hedging by call option applied



Source: own study.

The RoRaC is for January 2006 in conditions of call option 4,51% and 4,87% for hedging with swap. Similar analysis for July 2006 gave adequately 5,65% for call option and 5,43% for swap. It allows to state that this kind of hedging does not secure enough the expected level of gross margin (if TACC is assumed to be about 10%). There is necessary to introduce other hedging strategies, increasing the expected level of gross margin.

Final remarks

Efficient risk management requires the restructuring of approach to company management that should be executed in the following dimensions:

- development of consistent approach of whole risk profile valuation;
- combining the risk assessment with efficiency measurement and assessment of decisions in order to integrate the risk perspective with company finance;
- utilization of the possibilities of risk transfer.

The human element is also important. Everyone in the company, from managerial staff to operational worker should be aware of risks connected with the actions they take and of their influence on economic results of a company. General acceptance and understanding of the rules governing risk management and taking them into consideration in the system of motivation is a key to smooth restructuring of the approach in the above mentioned dimensions. It will cause effective management of the spheres especially prone to risk.

The most important statement is that in order to ensure the long term economic success of the company there should be taken risk only in the conditions allowing to work out the required level of the return on the capital incorporated in the company activity. Hence, the hedging instruments should be selected following the requirements of the company's return on capital, taking also into account the risk capital.

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