Czech-Austrian Winter and Summer School „Saving potentials of electricity trading of small and medium enterprises (SME) in industry “

Guidelines for the Student Papers

Kratochvíl Štěpán
&
Salvatori Christian

Co-operating Universities

Financial support by

Prague and Vienna, 2013

CONTENT

1. ABSTRACT

The most of the companies in the industry sector are using long term electricity contracts. This may not be a good strategy, because of the price of the electricity energy. The price of the long time contracts depends a lot on the maximum of the consumption in the whole period. With this is meant, that as the consumption is changing, the companies are still paying for the “maximum possible consumption”, what is quite expensive and unnecessary, if we can pretty precisely forecast our future consumption. So in our work we will try to split up the electricity contract into three parts. One will be a base consumption, which is the same all the year. Another will be a consumption, which will be covered by the medium term electricity contracts. The last part will be based on the electricity spot prices and will cover the jumps and peaks in the electricity consumption. Next we will think about trading on the spot and futures market, because of the decreasing nowadays trend in electricity prices. So our research question is, if the companies can save the money comparing the current long term electricity contract, the combination of the long, medium term and spot prices of the electricity and using spot and future trading.

2. INTRODUCTION

Before the 90’s the electricity market was regulated by state authorities. There was no trading in electricity, because electricity prices were set as a function of generation, transmission and distribution costs. In recent years, a deregulation process has taken place in many countries, and this has opened up electricity markets for trading and has interconnected adjacent markets. The main aim of deregulation was to introduce competition into generation and supply activities but not into transmission and distribution, which remain natural monopolies. Electricity prices are now determined by the interaction between supply (generators) and demand (suppliers, who trade with energy and ultimately sell energy to customers). Further because of the actual solar boom in the EU the installed capacity of photovoltaic (PV) grew up on a critical level and it’s still growing. The minimum installed capacity in Germany up to 2020 from a set of different scenarios (Quaschnig, (7)) is 50 GW. This is about half of total fossil and nuclear capacity in Germany in 2011. Now this installed capacity is influencing the marked significantly intermittently. This leads to the following future challenges see also Auer (9), Nielsen et al (17), Pantos (18), Wen (20), Lund (21), Lund (22):

From a rigid supply system to a breathing system:

We think that the major change must be a paradigm change in our understanding of the whole electricity system – from generation over “smart” grids to electricity-based services finally provided. This major change in thinking is to switch from a unflexible rigid static one-way system to an over-all “breathing” system, which allows bi-directional flows, technical flexibility in the system, incl. demand-side manangement, load management from utilities and storages (see e.g. Krajacic et.al. (15)) which also contribute to “breathing”.

New market structures: With respect to time-dependent market structures different new patterns will emerge. Regarding the role of hedging and future contracts an argument raised recently is that in markets with high shares of renewable energy sources no hedging is possible and future markets will break down. We think that actually the

opposite will be true: With hedging and tradable long-term contracts these instruments will take over to a large extent the role of capacity markets. E.g., long-term contracts traded years ahead on an annual basis will serve to reserve (and ensure) long-term capacity. The closer the delivery date comes the more fine-tuned will be the capacity reservation due to purchasing long-term contracts. E.g. if good hydro power conditions are observed less capacity will be hedged than vice versa. On the other hand there is a growing relevance of short-term markets like intraday- and secondary energy markets. In this context it is likely from our perspective that also “longer” term markets for secondary energy will emerge.

Due to this reasons this paper tries to figure out how a new pricing model for big customers, in this case an enterprise from the producing industry, could look like.

3. DEPENDENCE OF THE ELECTRICITY PRICES ON A RISE IN PV

There is the obligation to produce electricity from renewable sources, if it is possible. This rule is significant intervention into economy supply – demand model, which is the electricity prices set by. On Figure 1 and Figure 2 the comparison of the methodology of setting the price at 9.3.2009 and 4.3.2013 is shown. Both diagrams are for the Monday, the same hour (12:00) and the same season, so we suppressed the deterministic effect of the electricity prices. The realized prices were 48,71 EUR/MWh and 40,53 EUR/MWh for the 9.3.2009 and 4.3.2013 respectively. It can be seen from the diagrams that there is the rise of demand, which is the expected trend in the most countries and the decrease of the price. It can be seen too that the auctions are made with the strong negative prices nowadays. It is caused by the high costs for the power plant shutdowns or changing the power level.

Figure 1: Matching curve in 9.3.2009. The white line is the demand and the orange line is the supply. Thick line is the realized supply. [Source: www.ote-cr.cz]

Figure 2: Matching curve in 4.3.2013. The white line is the demand and the orange line is the supply. Thick line is the realized supply. [Source: www.ote-cr.cz]

The high percentage of the differences between these two diagrams is caused by the rise of the renewable sources. The renewables electricity sources move the merit order to the right, which cause the decreasing of the prices in the spot market. The following Figure 3describes this market act.

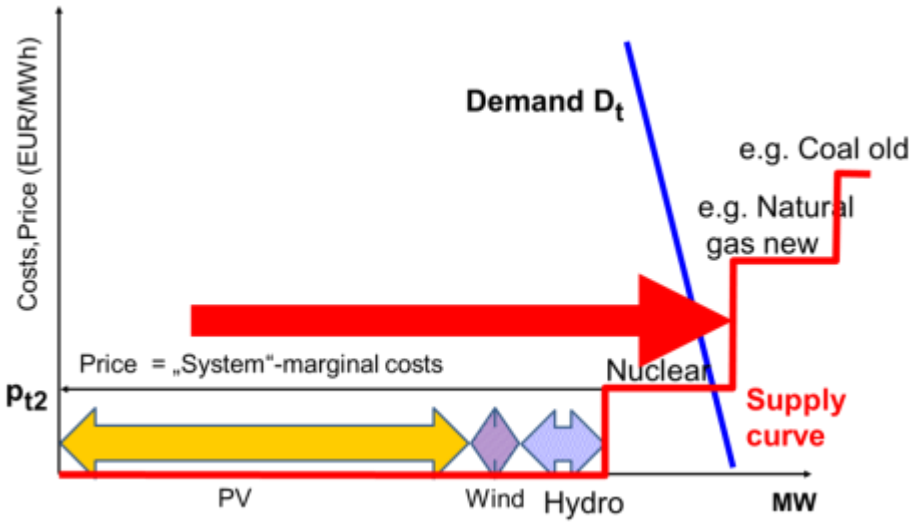

Figure 3: Merit order supply curve with additional wind and PV capacities (incl. run-of-river hydro) at on-peak time of a nice summer day with short term marginal costs for conventional capacities [R. Haas, 5]

This influences the price of the electricity both in the spot market and the prices of the electricity contracts. On the Figure 4 we can see that there is very high price volatility during day as the demand and RES supply develop. In the periods, where the demand is lower than RES supply, there is very low or even negative electricity prices (mostly peak times around noon). On the opposite in the periods with significantly higher demand than RES supply, the prices bid for electricity increase up to 16 cent/kWh. This very high volatility both in the range of the prices and in the high frequency of changes (there can be multiple changes of the price level in one day) will cause the spot price much more volatilities in the future and there will be more problems with the grid compensation and balance the supply and demand.

So because of this behavior of the spot electricity prices, we think that it would be reasonable to change long term electricity contracts for short term (spot based) contracts.

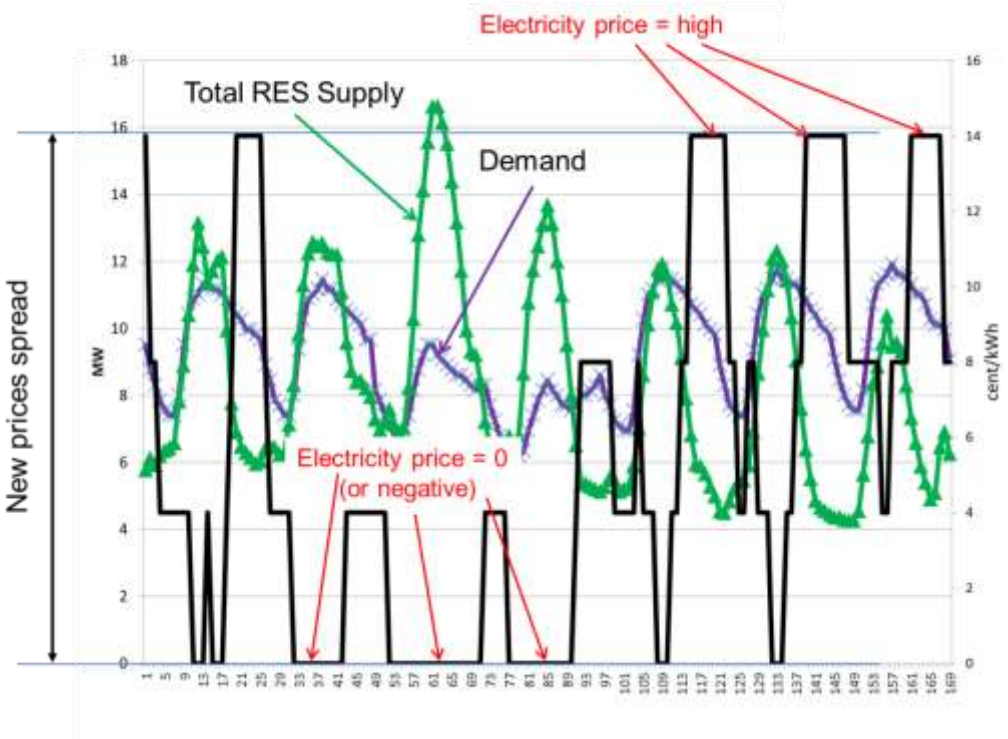

Figure 4: Development of total RES supply (wind, PV and hydro run-of-river) over a week on an hourly base in comparison to demand and the resulting electricity market prices with total costs for conventional capacities [R. Haas, 5]

4. DEVELOPMENT OF THE PRICES IN THE SPOT MARKET AND THE PRICES OF THE ELECTRICITY CONTRACTS

As can be seen from the 5 the electricity prices in the energy market have been decreasing since 2008. We can see a dependency between PV boom and the start of the decreasing of the electrictiy prices. As the price in the energy market falls down, the prices for electricity contracts are declining too. For example the price in the energy market decreased by 29% between 2008 and 2009, but the contracts for the households decreased only by 15%. In the year 2010 the prices of the electricity in the energy market was still decreasing, but the electricity price contracts more or less fluctuates and the decreasing can be seen only at some suppliers. Future development is believed to have the same trend. So for these reasons, we beliave that the long term contracts are not competitive in this market conditions and the decreasing trend of electricity price.

Figure 5: PHELIX future price CAL-14. Source: www.eex.com

We can use spot data too (Figure 6), where is the decreasing not so significant and could be difficultly seen from data so we added the regression line, where from x coefficient we can see that there is decreasing trend too (but a very weak).

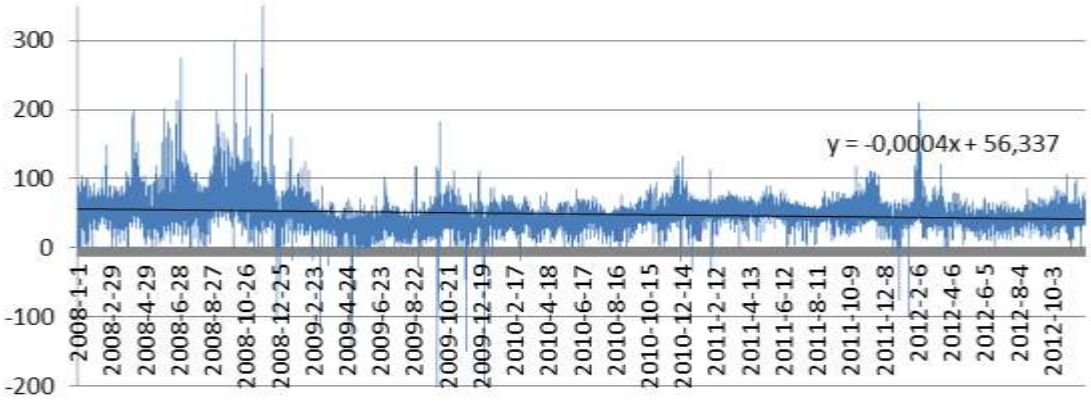

Figure 6: Spot prices (PHELIX index). Source: www.eex.com

5. NEW PRICE MODEL

In the recent years companies bought their electricity for a fixed mix price from the energy supplier. This fixed mix price was companied with very long term contracts. In this case only the energy supplier takes advantages from varying actual market prices (=spot prices). The upcoming trend is that companies also want to get the course savings from the actual electricity spot prices. The following figure shows the raw energy price from mix price contracts of Austria and the Czech Republic and the hourly spot market prices from Phelix and Swissix. In average the prices from the spot market is lower than the mix prices.

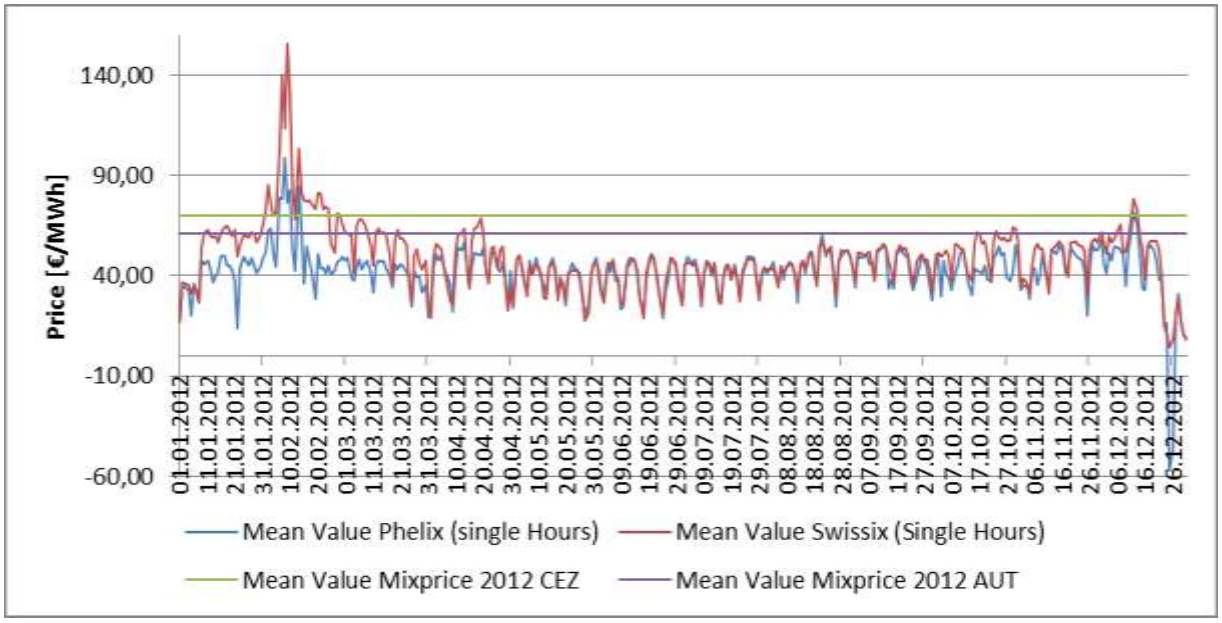

Figure 7: hourly spot prices (Phelix and Swissix) and mix prices of AUT and CEZ

Phelix is the Name for the spot price market from Germany and Austria. The spot market of the Czech Republic, Poland, and Slovakia is linked to Phelix. Also French spot market is linked to Phelix. The spot market of Switzerland is not linked to Phelix and hence it is relevant to include it separately.

Because of clarity in the Figure 7 above there are only illustrated the spot prices from Phelix and Swissix based on single hours. But on the market there are also spot prices based on daily rating and monthly rating. The following table shows the mean value of each of these spot products for the year 2012.

Phelix (Single Hours) [€/MWh]	Swissix (Single Hours) [€/MWh]	Phelix (daily) [€/MWh]	Swissix (daily) [€/MWh]	Phelix (monthly) [€/MWh]	Swissix (monthly) [€/MWh]
42,69	49,62	42,27	49,02	46,87	53,65

Table 1: Mean value of each of the spot products for the year 2012

In Table 1 above it can be seen that the mean value price of the hourly spot prices is the lowest and the longer the evaluation period is the higher the mean value of the prices are increasing. Further the mean value spot prices for Swissix are higher than the for Phelix

Maybe this could also be a result of the higher amount of PV in Germany and Austria compared to Switzerland.

For our case of study we used the consumption diagram of one anonymous Austrian company, which deals with industry production. With the year consumption about 540 GWh we can take this company as a large buyer. We use data for every 15 minutes from 1.1.2012 to 30.12.2012. On the 8 you can see the load curve of the company for the year 2012. It can be seen very strong intra-day and intra-week patterns. This consumption behavior can be observed over the whole year.

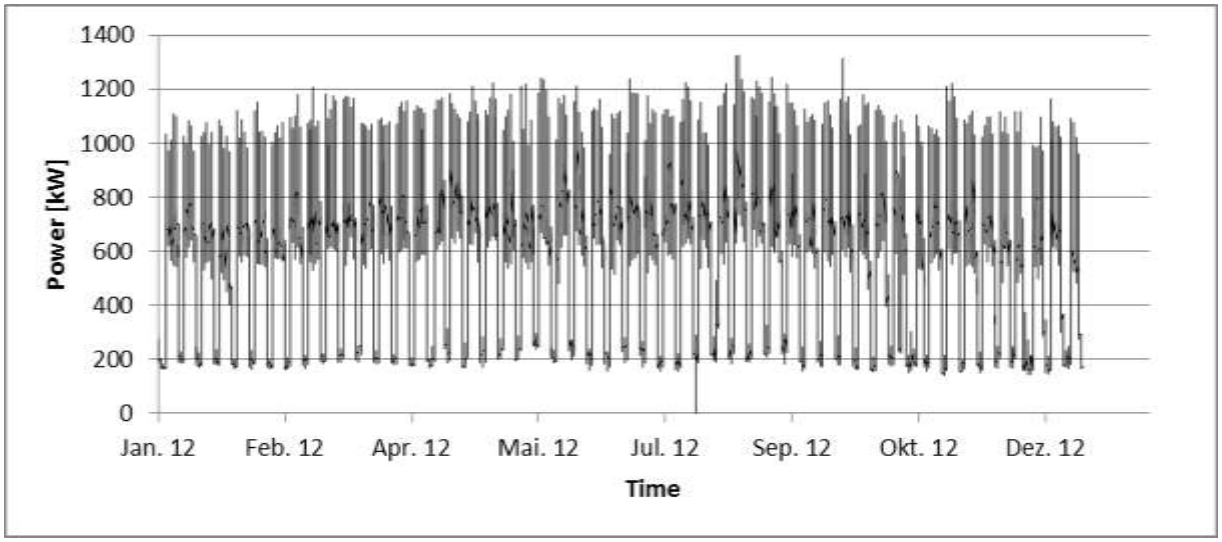

Figure 8: Load Curve from the year 2012 of the chosen company

Consequently we are dividing the demand into following quantity areas:

- Base Load Demand (<180kW):
  It is about 180kW and describes the electrical power which is needed constantly over the whole year
- Work Load Demand (>180kW and <550kW):
  This is the background consumption for the working days and is between 180kW and 550kW
- Peak Load Demand (>550kW):
  This power is only needed in single hours when a lot of big machines are switched on.

The following figure takes focus on only one month to show daily and hourly patterns more detailed.

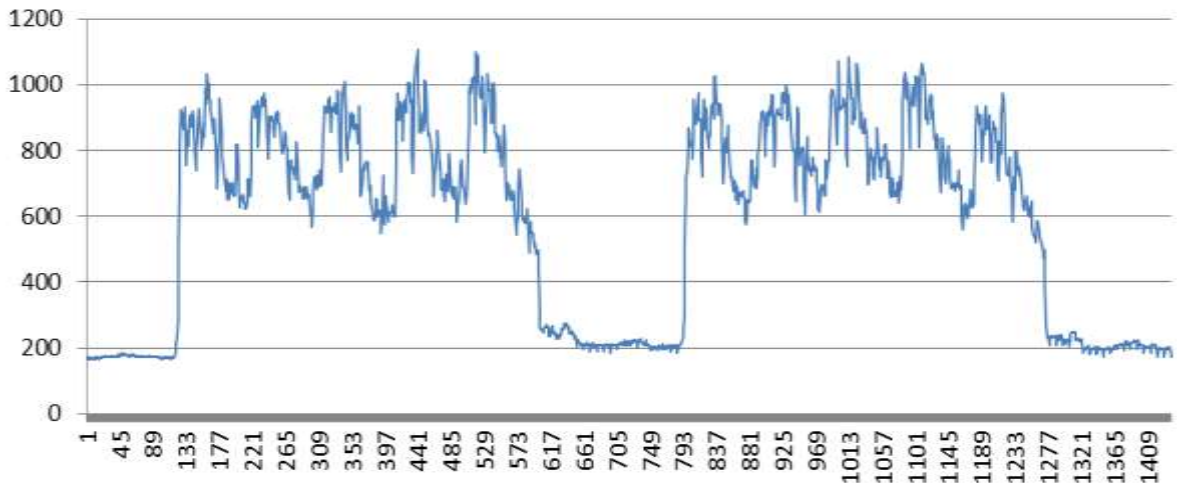

Figure 9: Load Curve from January 2012 of the chosen company

In our new pricing model each of these areas is covered by a different contract type. We assume that our company is buying its energy from a broker who is delivering different companies with electrical energy. The broker is trading energy on the derivate market and offering the electrical energy in the moment of fulfilment to the actual spot prices. His gain is the difference between the derivate price and the spot price.

The Base Load Demand is constant over the whole year but could also change more often. This Demand gets covered by a monthly spot price contract. The Work Load Demand is nearly constant over the day and so this demand can get covered by a daily spot price contract. The Peak Load Demand is covered by a single hour spot price contract.

This strategy requires a monitoring system on the company's side and a very good energy forecast based on the production plan. Based on the predicted load curve of our company we want to create a new price model for electricity market and show the differences to the actual price model. The following figure shows the cost curves of the new and actual price model.

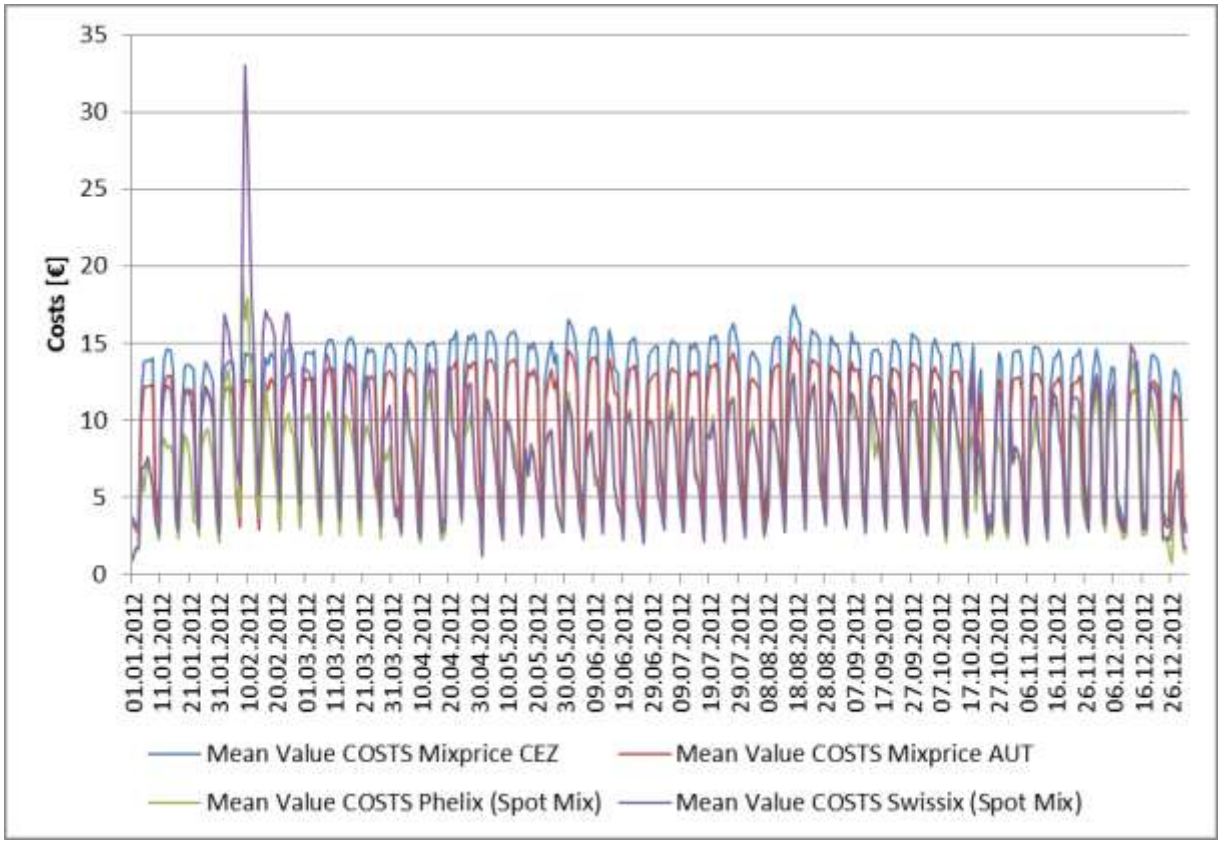

Figure 10: Cost curves of the new and actual price model

It can be seen on the Figure 10 that in the majority of cases the costs of electricity are lower if the new price strategy would be used instead of the strategy with mix prices. The following

COSTS Phelix (hourly)	COSTS Swissix (hourly)	COSTS Mixprice 2012 Industry CZ	COSTS Mixprice 2012 Industry AUT	COSTS Phelix (Spot Mix)	COSTS Swissix (Spot Mix)
242.093 €	279.086 €	392.659 €	345.677 €	246.135 €	282.503 €

Table 2 shows the electricity costs for the old and the new pricing system for the companies demand in 2012.

COSTS Phelix (hourly)	COSTS Swissix (hourly)	COSTS Mixprice 2012 Industry CZ	COSTS Mixprice 2012 Industry AUT	COSTS Phelix (Spot Mix)	COSTS Swissix (Spot Mix)
242.093 €	279.086 €	392.659 €	345.677 €	246.135 €	282.503 €

Table 2: Electricity costs for the old and new pricing system

6. CONCLUSION

We have achieved results, which range between 242.093 Euro and 392.659 euro per year. The highest value is about 1,6x the smallest value, which means that because of these big differences in the prices for contracts, there should be pay particular attention for right choose of the electricity contracts.

- As we expected, the lowest prices for the electricity contract were achieved by the hourly spot market. Although this price is the lowest one it will not be possible to buy the whole demand on the hourly spot market. Therefore prediction preciseness and trading intensity must be very high und therefore to risk and cost intensive.

- On the other side the long term contract with the fixed price is much more expensive and hence the worst opportunity. But right now this is the consisting solution for also big customers like companies similar this one.

- Our spot market contract mix model is placed in the middle very close to the hourly spot price model.

The total result of this work is then that the companies with big electricity consumption should not use the long term electricity contract and start to think about using of the short term and flexible contracts.

References

[1]CEZ elektrické kontrakty. Reached 25. 2 2013, from ČEZ: http://www.cez.cz/cs/pro-zakazniky/elektrina/ceny.html

[2]Operátor trhu. Reached 25. 2 2013, from z www.ote-cr.cz

[3]The Economics of Nuclear Power. Reached 30. 3 2013, from World Nuclear Association: http://www.world-nuclear.org/info/Economic-Aspects/Economics-of-Nuclear-Power/#.UVbZiFcYvYU

[4]www.eex.com. Reached 30. 3 2013, from Central European energy exchange: www.eex.com

[5] Reinhard Haas, Georg Lettner, Hans Auer, THE LOOMING REVOLUTION: HOW PHOTOVOLTAICS WILL change ELECTRICITY MARKETS IN EUROPE FUNDAMENTALLY

[6] C. Hiroux, M. Saguan, Large-scale wind power in European electricity markets: Time for revisiting support schemes and market designs?