



How the CO₂ allowances price and the biomass co-burning influence the central heating plant economy?

Monte Carlo simulation of the pretax profit for the selected Czech company

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Study background

- Central heating and power plant
- **Installed capacity:**
 - Heat: 214 MWt
 - Electricity: 30 MWe
- **Production:**
 - Heat sale: 777 TJ (in 2007)
 - Electricity sale: 116 523 MWh (in 2007)
- Burning mostly lignite
- Current emissions of CO₂ around 250 000 tons
- Relatively low specific emissions
- Cogeneration – electricity and heat production
- Five boilers (3 in use, 2 emergency)



Contemporary situation

- Preparing 2 boilers reconstruction:
 - Costs: aprox. 500 millions crowns (19 mil. Euro)
 - Lowering contemporary emissions level
 - Subsidy of aprox. 40 % from State Environmental Fund is planned
 - New fluidized-bed boiler would:
 - Increase the efficiency by 8-9 % (from contemporary 87 % to 90 %)
 - Enable biomass coburning up to max. level of 40 %



Technique used for simulation

- For all the simulations the Visual Basic supplement for Monte Carlo simulations in MS Excel was used
- 1000 iterations were simulated for each analysed scenario and random variable
- The evaluation was focused on the pretax profit
- The results of the simulations are displayed with the upper and lower bounds



Technique used for simulation

- These bounds characterizes the interval where the result of the simulation will be with the 80 % probability
- The 2002-2007 data are adopted from the annual company reports
- The projection is done for 2008-2020
- The inputs were randomly generated according to the following type of distribution and its parameters

Random variables parameters

Model inputs	Distribution type	Lower bound	Upper bound	Annual increase (mean value, standard deviation)
Allowance price (€)	Equalized distribution	5 €	50 €	3%
		Mean value	Standard deviation	
Electricity sale price	Normal distribution	1 384	107	2%
Heat sale price	Normal distribution	301	16	3%
Amount saled (electricity)	Normal distribution	116 523	5 061	1%
Amount saled (heat)	Normal distribution	777	57	-2%
Fuel price (Kč/GJ)	Normal distribution	54,9	5	4%

Emission trading in the model

- The emission trading in 2013-2020 was modeled according to the 2003/87/EC directive amendment:
 - In 2013 80 % of allowances according to the NAP II allocated for free
 - From 2013 allocated amount lowered by 10 % a year
 - Balance of allowances is traded at the market for the price given by the Monte Carlo simulation with the given type of distribution and parameters of that distribution
 - The exchange rate is given for the whole period to 27 CZK/EUR.

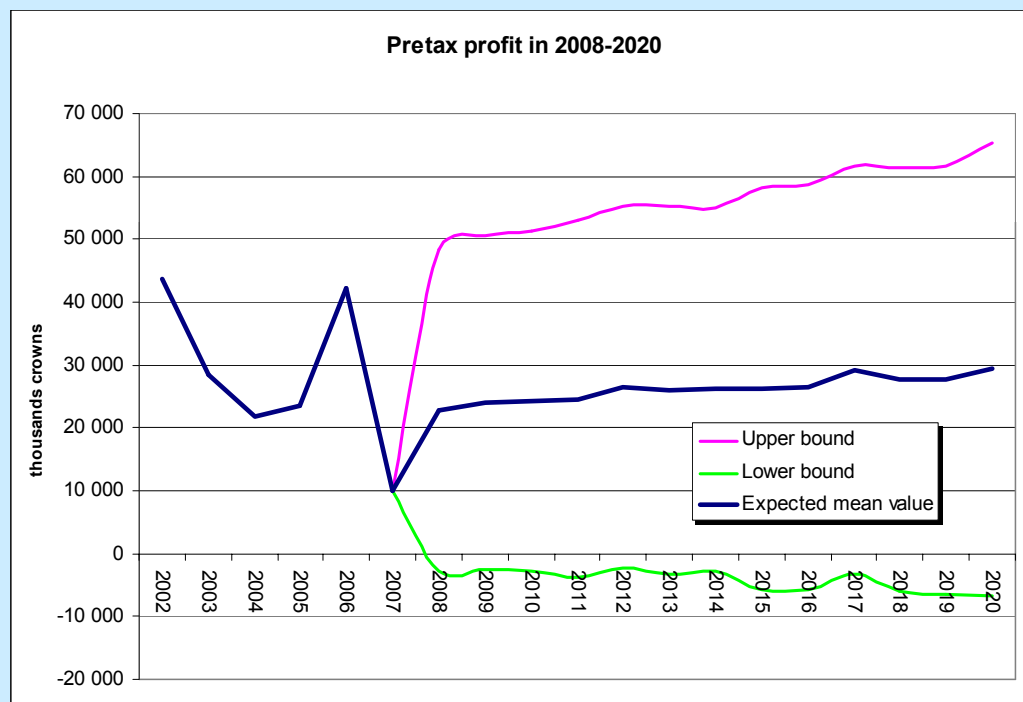


Scenario 1 - Description

- Modelled expected **pretax profit**
- No EU ETS existence
- In fact: Business As Usual variant



Scenario 1 – Results of the simulation





Scenario 1 – Results of the simulation

- Mean expected pretax profit between 20 and 30 mil. Crowns
- With the probability of 80 %, one could expect 0 to 60 mil. crowns of the pretax profit in the analysed period

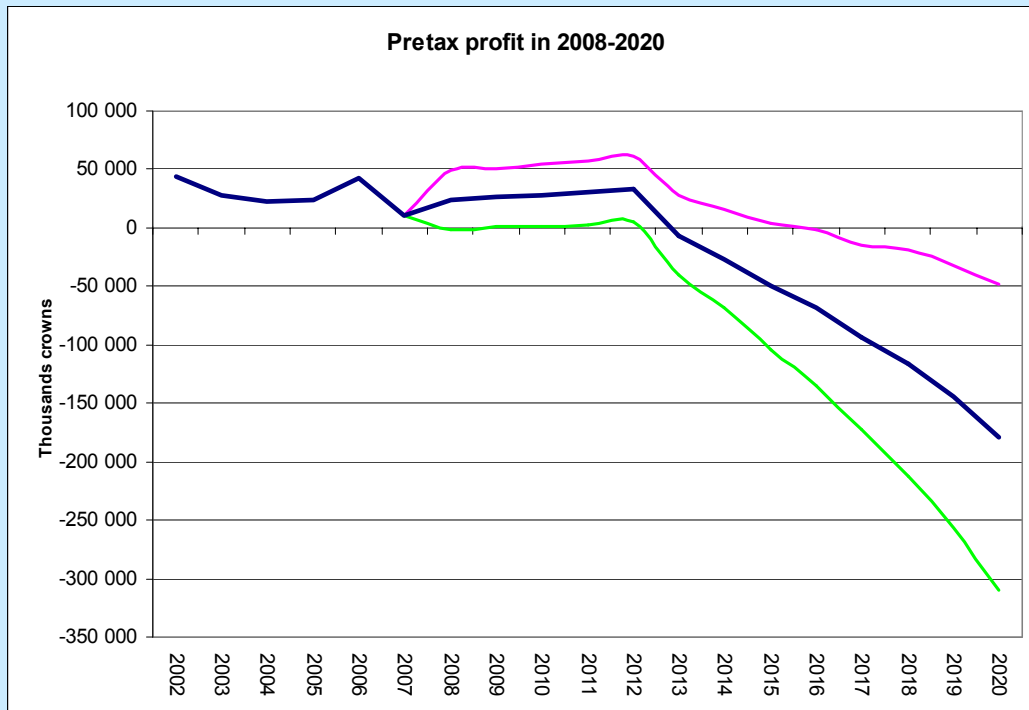


Scenario 2

- Expected pretax profit
- EU ETS in place
- No additional costs connected with the allowances transferred to the price of the heat and/or electricity



Scenario 2 – Results of the simulation



Scenario 2 – Results of the simulation

- Sharp decrease of the profit since 2013;
reasons:
 - No CO₂ emissions lowering
 - Relatively high allowance price (equally distributed in the range of 5 - 50 € with 3% expected price increase of the allowance price in the years).
- Mean expected pretax profit up to -180 mil. crowns in the last year of the simulation

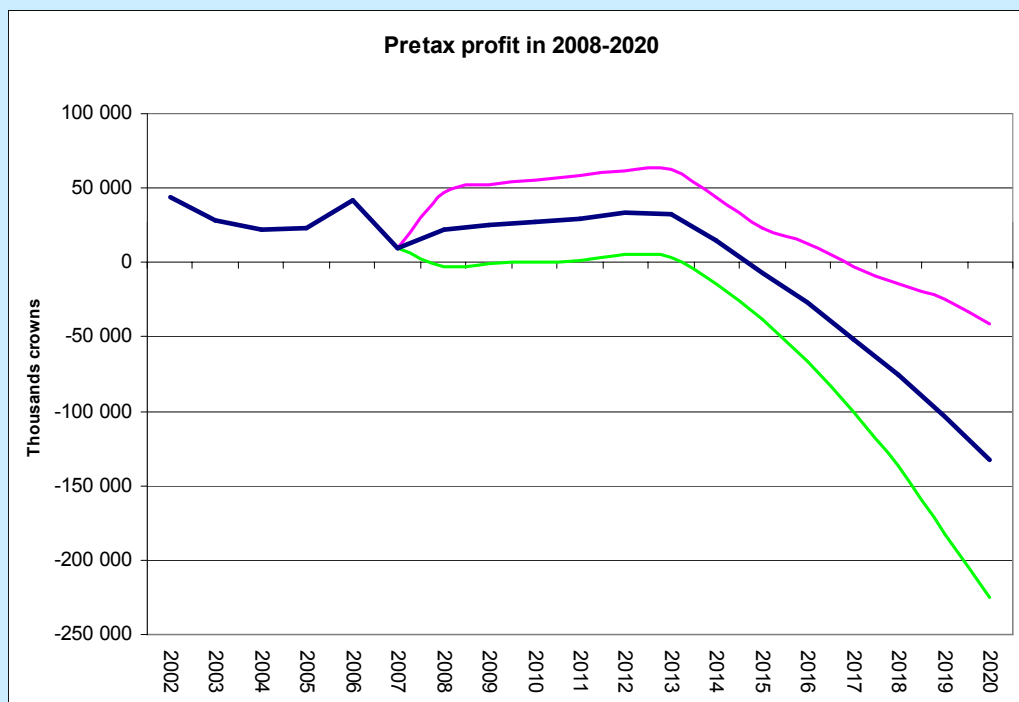


Scenario 3

- Expected pretax profit
- EU ETS in place
- No additional costs connected with the allowances transferred to the price of the heat and/or electricity
- Preparing 2 boilers reconstruction:
 - In operation since 2013
 - Increase the efficiency by 8-9 % (from contemporary 87 % to 90 %)
 - Fuel consumption savings
 - Biomass coburning (30% of the fuel consumption)
 - Depreciation of the investment in the period of 20 years
 - Max. subsidy gained (40 % of the investment cost)
 - CO₂ emissions lowered because of the biomass coburning and efficiency increase



Scenario 3 – Results of the simulation





Scenario 3 – Results of the simulation

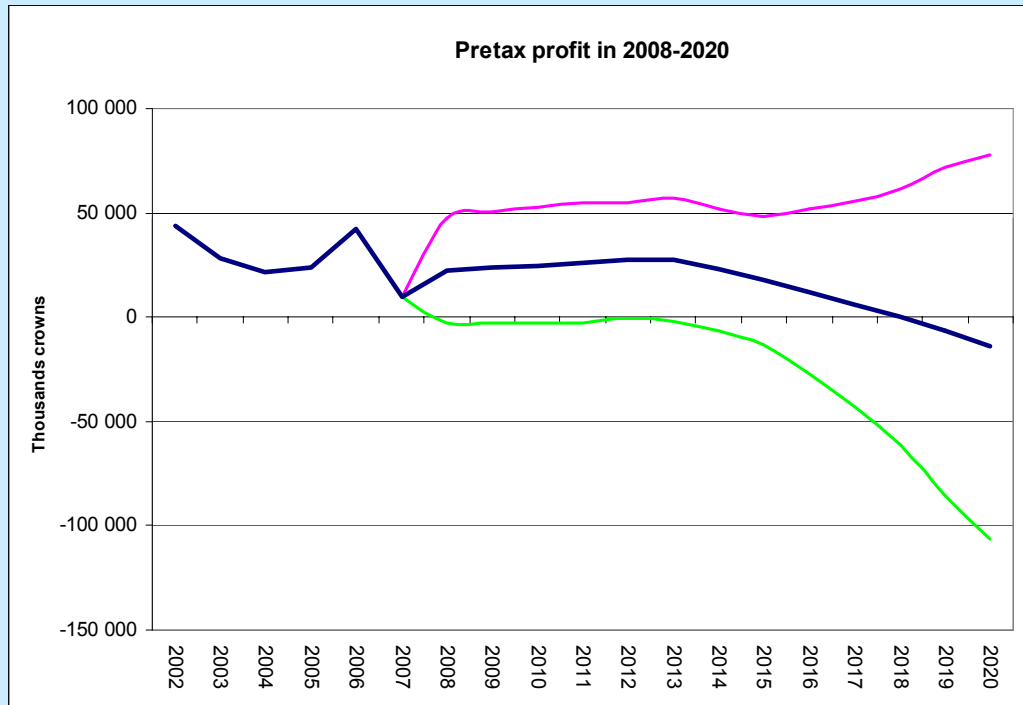
- Not so fast profit decrease via CO₂ emission lowering
- In spite of it since 2015 the company lose all profit
- Mean expected pretax profit up to -130 mil. crowns in the last year of the simulation



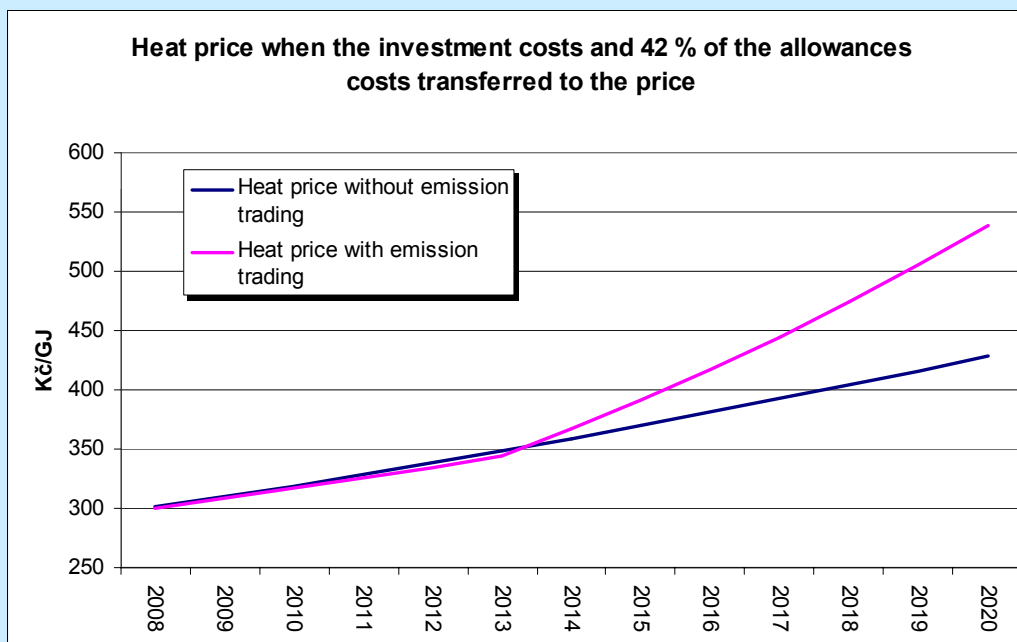
Scenario 4

- EU ETS in place
- Till 2013 the allowances surplus is in place and their sale enable to lower the prices compared to BAU scenario
- Since 2014 the company has to buy the allowances
- **Compared to the „SCENARIO 3“ additional costs connected with the allowances are transferred to the price of the heat and/or electricity**
 - Nowadays:
 - 42 % of the energy from combustions processes is used for heat production and
 - 58 % for the electricity production
 - the additional costs were allocated in the same proportion

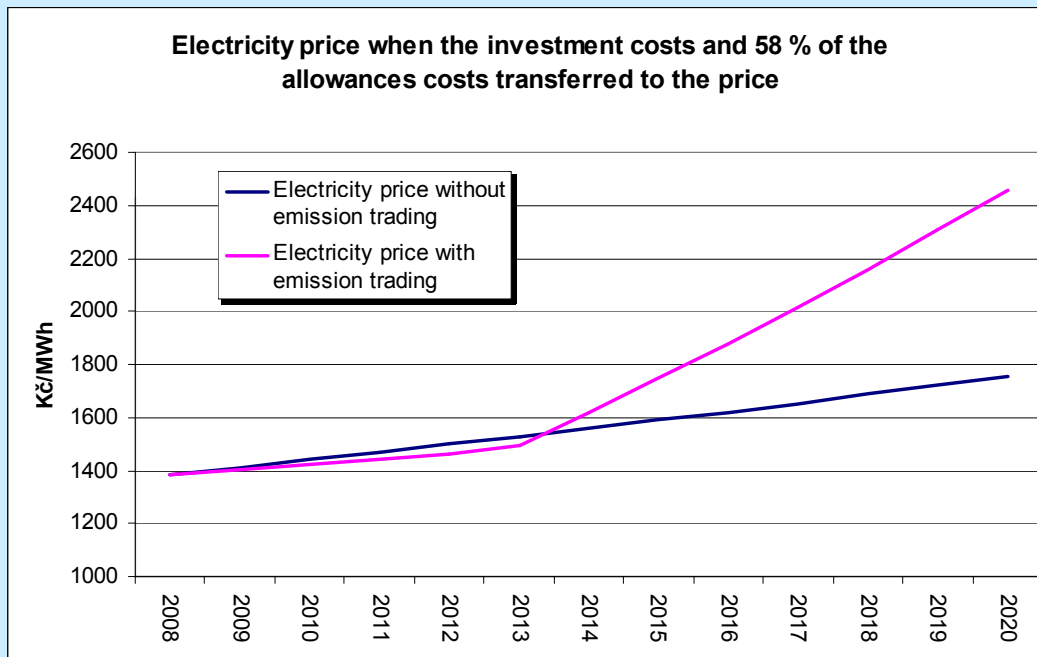
Scenario 4 – Results of the simulation



Impact on the heat price



Impact on the electricity price



Scenario 3 – Results of the simulation

- **To keep positive profit it will be necessary to increase the electricity and heat price significantly**
- This conclusion is valid even when:
 - CO₂ emissions were lowered
 - the subsidy was gained
 - the biomass is coburned
- It is a question whether this simulation is not an indication of the hidden taxation in form of environmental regulation



Conclusion

- The new trading scheme after 2012 will have significant impact on the company profit despite the modern technology used utilising 30% of biomass as energy input
- In order to keep positive profit it will be necessary to increase prices (compared to BAU scenario):
 - HEAT: 2 % in 2014 to 26 % in 2020
 - ELECTRICITY: 4 % in 2014 to 40 % in 2020



Discussion

- Only simulation – be aware of the assumptions and expected distributions and parameters of the random variables
- But the fact is that if current amount of emissions (250 thous. tons CO₂) should be covered by purchases in auctions, then costs would increase for mean expected price 30 € by 200 mil. crowns annually. When compared to current economic indicators, it represents:
 - 46% of total revenues in 2007 (435 mil.)
 - 48 % of total costs in 2007 (420 mil.)
 - **Twentyfold** of pretax profit in 2007 (10 mil.)



We wish you to have low prices kept

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