Visualization of electricity market fundamentals

Case: Nordic market

Project plan

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1 BACKGROUND

The deregulation of the Nordic electricity markets has implied a great change to the ways of working in the electricity companies. The electricity is traded at the Nordic Power exchange, Nord Pool, and changes in the fundamentals that effect the supply or demand are immediately reflected in the electricity prices.

The Nordic power exchange organizes trade in standardized physical and financial power contracts. The hourly electricity price is set by an equilibrium model where the supply and demand of all the market participants are matched day-ahead and the equalizing price, called spot price, acts as the basis for the derivatives. The financial contracts can be divided into futures and forwards. The futures traded at Nord Pool include weeks and four-week blocks. The forwards on the other hand are years and seasons.

Due to the non storable nature of electricity, the time dependent variation present in the demand results in a strong seasonal, weekly and daily profile in the electricity spot price. The Nordic market has a significant electricity heating customer base, considerable amount of Combined Heat and Power (CHP) production, and most significantly roughly 50 % of the electricity is hydro based. The hydropower allows the energy to be stored within certain limits in reservoirs, which decreases the short-term variation in the spot price. But the total amount of hydropower on the market depends on the amount of yearly rainfall and snowfall and that causes big variations in the yearly spot price levels.

As the electricity cannot be stored, there is no strong relation between the spot price present and the prices of financial derivatives on spot price. Instead, the future prices reflect the market expectations on the future supply and demand, which makes the financial electricity markets quite unique.

Since the number of fundamentals that influence the spot price and the derivative prices is large, there is a need to systematize and visualize the information in a good way. A single person can not keep track of everything, so there is a need to do this in a centralized way that can be used throughout Fortum. Of course, different persons have different needs, but in general the basic important fundamentals are the same.

2 GOALS

The primary goal of the project is to design and implement a fully functional web based market analysis device for the Nordic power market to be used within Fortum. The idea is that people throughout the organization that are in need of fundamental data for their decision making always should have access to the latest data and all the important data should be found in one place.

Key-indicators and -indices should be identified and visualized in a way that the user of the service will intuitively see the most important indicators and their effect on the price of electricity.

All the relevant data should be collected in one Excel-tool where the indices are calculated and the necessary pictures and tables created. This Excel-tool is what the analysts work with when they update the data and the planned pictures and tables. The tool needs to be well documented and dynamic enough to allow changes in the future. Most of the data available on the web page will be created by the Excel-tool so it needs to function flawlessly. It should be easy to connect the tool to other sources, so

that the amount of manual work can be kept minimal. However, the connection to external sources does not belong to this project.

Finally, the web pages are where all the work done on the project comes together. The web pages should be implemented using Market Analysis' existing web solution. In addition to displaying the data generated by the Excel-tool, an easy to use and intuitive interface for the page has to be designed so that the user of the page finds the relevant information quickly and easily. When the project is finished the web pages should be fully functional and documented.

3 PLAN OF ACTION

At a first glance, the project can be divided into three parts. The first and most important part is understanding the fundamentals and the relations between them, as well as identifying key indices. In order to create a functional market analysis web service the project team must first analyze historical data in order to identify the most important fundamentals and connections and correlations between them. This analysis will also help decide how the data available should be visualized and presented to the users. The second part consists of planning and building the Excel-tool and the third part is planning and implementing the web-page structure. In addition to this everything has to be well documented and tested.

An important aspect is the actual needs of the potential users of the service. The fundamentals are already familiar to the users and can be accessed via different sources. The real task is therefore to try to unify all data in a way that is easy to understand and to try to visualize the data from different points of views. Since there is a lot of raw data and it is difficult for a single person to keep track of and update everything, there is a good possibility for this project to produce usable results.

3.1 Identified actions

The following main actions were identified by the project group.

1. Preparation of project plan
   This should be straight forward. The project plan is divided into different parts that are written by different members of the group.

2. Planning of the methodological part
   This part is the most important for the succeeding of the project. If the results derived here are poor, the benefit of the final visualization in the web solution will also be poor and of no practical use for Fortum. The task includes clarification of customers needs, going through the fundamentals to be visualized, and acquiring of market data. Thinking of fundamentals' inter-relations to be visualized and identification of indices and other key-values as well as appropriate and easy-to-understand visualizations methods are also important parts of this task. Finally an acceptance from customers is needed before this task can be considered to be completed.

3. Preparation of the intermediate report
   This should also be straight forward.

4. Planning of the Excel tool
   An important part of this task is also clarification of customer needs. After that the tool functionality and technical architecture can be planned.

5. Implementation of the Excel tool
   The goal is to keep the Excel-tool as simple as possible without giving up any of

the functionality. This makes the tool easier to expand and develop further in the future.

6. Planning of the web pages
   Again, the clarification of customer needs is important. After that the logical page structure can be planned.

7. Implementation of the web pages
   Since the existing web solution of the Market Analysis function is to be used, this task consists of learning how it works and then implementing the pages according to our plan.

8. Testing
   This testing part consists of our own test of both the excel-tool and the web pages. Thereafter a user acceptance test is carried out.

9. Preparation of the documentation
   A user's and developer's manual shall be written for both the Excel-tool and the webpages. In according to this also the chosen fundamentals, analysis and visualization methods shall be documented.

10. Preparation of the final report and seminar presentation
    This should be straight forward.

11. Delivery of project results to the customer
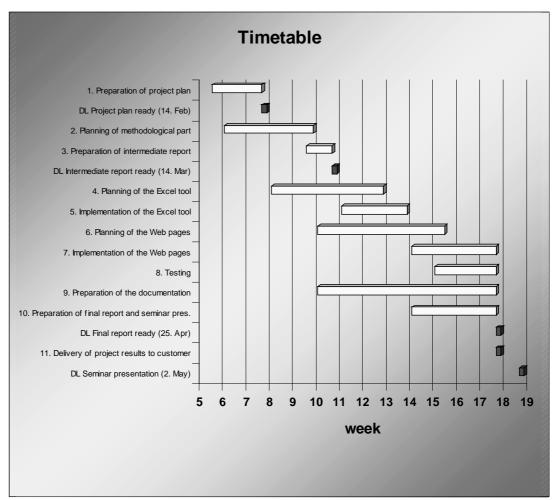
12. Seminar presentation

See appendix A for a detailed list of actions and the time needed.

3.2 Timetable

The timetable of the identified tasks can be seen in the chart below. The chart only visualizes the feasible time interval for each task and don't reflect the amount of time necessary to carry out the tasks.

Timetable

1. Preparation of project plan	
DL Project plan ready (14. Feb)	
2. Planning of methodological part	
3. Preparation of intermediate report	
DL Intermediate report ready (14. Mar)	
4. Planning of the Excel tool	
5. Implementation of the Excel tool	
6. Planning of the Web pages	
7. Implementation of the Web pages	
8. Testing	
9. Preparation of the documentation	
10. Preparation of final report and seminar pres.	
DL Final report ready (25. Apr)	
11. Delivery of project results to customer	
DL Seminar presentation (2. May)	

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

week

3.3 Resourcing

See appendix A.

4 RISKS

We identified the following risks in the project.

4.1 Inappropiateness of chosen analytical methods

If the chosen analytical methods are inadequate to capture the relevant characteristics of market data, the accuracy of the results obtained might be poor and even misleading the decision making.

Risk is to be minimized by testing each hypothesis with real market data before considering which methods to include in the final solution.

4.2 Missing of project timetable deadlines

If the planned analysis methods or tool functionality turn out to be inadequate, additional effort must be put to develop adequate methods or tools. The required additional effort might cause delays to the initial project timetable.

Risk is to be minimized by testing each hypothesis as soon as possible with real market data before considering which methods to include to the final solution.

4.3 Unsustainable implementation

If the chosen methods are implemented in a quick & dirty fashion, the resulting tool might be very difficult to maintain and develop further.

Risk is to be minimized by planning and documenting the implementable tool thoroughly according to proper application development discipline before any actual implementation work is carried out.

4.4 Future expansion and development of tool difficult

If the future expansion and development of the tool functionality is not properly taken into account in the implementation planning phase, the enhancement of the tool might be difficult (although the implemented part could be done in a sustainable fashion).

Risk is to be minimized by including the foreseeable future expansion and development needs into the planning and documenting phase according to proper application development discipline.

4.5 Complex and inadequate documention

If the documentation is too complex and/or inadequate, the existing functionality of the tool might not be possible to clarify. Lack of proper documentation could hinder the future development of the tool as well.

Risk is to be minimized by preparing proper documentation including a user's manual and a developer's manual. Use of tool will be tested within the project by future end-users and developers of the tool.

4.6 Personnel risks

If crucial parts of the project workload are scheduled for a small set (e.g. one individual) of people, the possible unexpected unavailability of these resources might cause severe problems like delays in project timetable, additional costs etc.

Risk is to be minimized by dividing the workload evenly among project group and preparing proper follow-up documentation of the work done so far throughout the project.

Appendix A

Work hours/week (TQ TP PV VR per week):

Week	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Work hours	2 2 2 2	17 12 9 9	9 9 7 7	23 23 16 16	19 22 16 16	9 8 7 4	5 9 11 8	5 7 9 8	5 0 18 8	0 9 0 14	24 11 0 25	34 5 17 0	6 3 8 0	0 0 0 0

Actions	Time (weeks)	Deadline date	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18
1. Preparation of project plan	0,6		2 2 2 2	6 3 3 3							x	x x	x	x	x	x
Project plan ready		14.Feb			Deadline						x	x	x	x	x	x
2. Planning of methodological part	4,5										x	x	x	x	x	x
2.1 Clarification of customer needs	0,3			4 2 2 2							x	x	x	x	x	x
2.2 Fundaments to be visualized	0,3			3 3 2 2							x	x	x	x	x	x
2.3 Acquire required data	0,4				1 1 1 1	2 2 2 2	1 1 1 1				x	x	x	x	x	x
2.4 Fundament inter-relations to be visualized	0,9			4 4 2 2	3 3 3 3	3 3 3 3					x	x	x	x	x	x
2.5 Indeces and other key-values	1,5				5 5 3 3	6 10 3 3	5 8 5 5				x	x	x	x	x	x
2.6 Visualization methods	1,0					3 3 3 3	8 8 5 5				x	x	x	x	x	x
2.7 Acceptance from customers	0,2						2 2 2 2				x	x	x	x	x	x
Methodological part planned		28.Feb					Deadline				x	x	x	x	x	x
3. Preparation of intermediate report	0,2							3 2 2 2			x	x	x	x	x	x
Intermediate report ready		14.Mar							Deadline		x	x	x	x	x	x
4. Planning of the Excel tool	1,0										x	x	x	x	x	x
4.1 Clarification of customer needs	0,3					6 2 2 2					x	x	x	x	x	x
4.2 Planning of tool functionality and architecture	0,7					3 3 3 3	3 3 3 3	3	1	1	x	x	x	x	x	x
Excel tool planned		21.Mar								Deadline	x	x	x	x	x	x
5. Implementation of the Excel tool	1,3							3 3 8 3	3 3 8 3	3 x 10 3	x	x	x	x	x	x
Excel tool ready		31.Mar									x	Deadline	x	x	x	x
6. Planning of the Web pages	0,9							x	x x	x	x	x	x	x	x	x
6.1 Clarification of customer needs	0,3						6 2 2 2				x	x	x	x	x	x
6.2 Planning of logical page structure	0,6							2 2 2 5 2	5 2 x	5	x	x	x	x	x	x
Web pages planned		10.Apr									x	x	Deadline	x	x	x
7. Implementation of the Web pages	0,8										x	x 8 8 x 8 8	x	x	x	x
Web pages implemented		20.Apr									x	x	x	Deadline	x	x
8. Testing	0,7										x	x	x	x	x	x
8.1 Own test of Excel tool	0,3										x	x	4 7 x	x	x	x
8.2 Own test of web pages	0,3										x	x	3 x 7	x	x	x
8.3 User acceptance test	0,2										x	x	5 2 x	x	x	x
Testing completed		22.Apr									x	x	x	Deadline	x	x
9. Preparation of the documentation	1,7										x	x x	x	x	x	x
9.1 Chosen fundaments, analysis & visualization methods	0,8					4	4	4		x	x 6 x	4 6 x	4	x	x	x
9.2 Technical Excel tool implementation (user's & developer's manual)	0,5								x 8	x	x	5 x	5 x	x	x
9.3 Technical Web page tool implementation (user's & developer's manual)	0,4									x	x	x 3 3	x 7 3	x	x	x
Documentation completed		23.Apr									x	x	x	Deadline	x	x
10. Preparation of the final report and seminar presentation	1,3										x	x 3 x 3 6 5	x 3 10 5 3	x 6 3 3 x	x	x
Final report ready		25.Apr									x	x	x	x	**Deadline**	x
Seminar presentation ready		25.Apr									x	x	x	x	Deadline	x
11. Delivery of project result to customer		25.Apr									x	x	x	x	Deadline	x
12. Seminar presentation		2.May									x	x	x	x	x	**Deadline**