

MAKING THE ELECTRICITY CONSUMPTION VISIBLE

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ABSTRACT

Vattenfall has completed a large evaluation of actual customers' interest in more advanced consumption services accessible through the Internet. Approximately 2500 private customers in Sweden participated in the 12-month test, giving them the opportunity to follow up on their electricity consumption on an hourly level. The result from this test is now the base for a roll-out of a similar application in Vattenfall Finland and refined requirements on operations in Sweden, regarding preparations for a possible roll-out.

INTRODUCTION

Vattenfall has completed a large evaluation of actual customers' interest in more advanced consumption services accessible through the Internet. The unique project, Customer Information Pilot (CIP), included a demonstration over 12 months with 2,500 of Vattenfall customers in Sweden. The pilot project was executed as a joint project together with different parts of Vattenfall Sweden including Distribution, Sales, Customer services and the Energy efficiency program.

There is now a 100% rollout of smart meters in Sweden and the new opportunities these smart meters provide are now starting to bear fruit. During 2010 Vattenfall Finland released an application based on the results from the project to all our 350000 Finnish customers and a similar rollout for Swedish customers is now planned.

The pilot was preceded by a number of studies including also demonstrations of technical possibilities with smart meters and a Swedish/Finnish customer evaluation of a web-based customer interface mock-up.

The visualization of actual hourly consumption is an important step in achieving demand side participation in the future Smart Grids. This pilot project provided a state of the art tool that supported the customers in both energy awareness and electricity saving activities.

PILOT PREREQUISITES

The target group was primarily private customers spread all over Sweden. In addition to that a small group of small business customers were included as a separate group. In one week, a total of 2519 out of the 15355 randomly selected customers had registered to join the test. That is a total sign up rate of 16.4%, a lot higher than expected.

The customer criteria to be invited were:

- The customer needed to have both a Distribution and Sales contract with Vattenfall
- A smart meter installation of a specific generation.
- Yearly electricity consumption between 1500-50000 kWh.

APPLICATION FUNCTIONALITY

The application included a number of different energy related follow up functions.

- Overview dashboard
- Graph tool
- Energy log function
- Message function (deviation and outages)
- Price calculator
- Energy experts

The included data sources was

- Hourly electricity consumption values delivered once a day from the smart meter
- Power outage info, once a day
- Local outdoor temperature (daily average value)
- General customer background info (address, yearly consumption etc)

Overview dashboard

The start page includes summarized info for most included functions, such as comparison of total consumption for different periods, outages and messages. Only by looking at this overview page the customer got access to much more information than before.

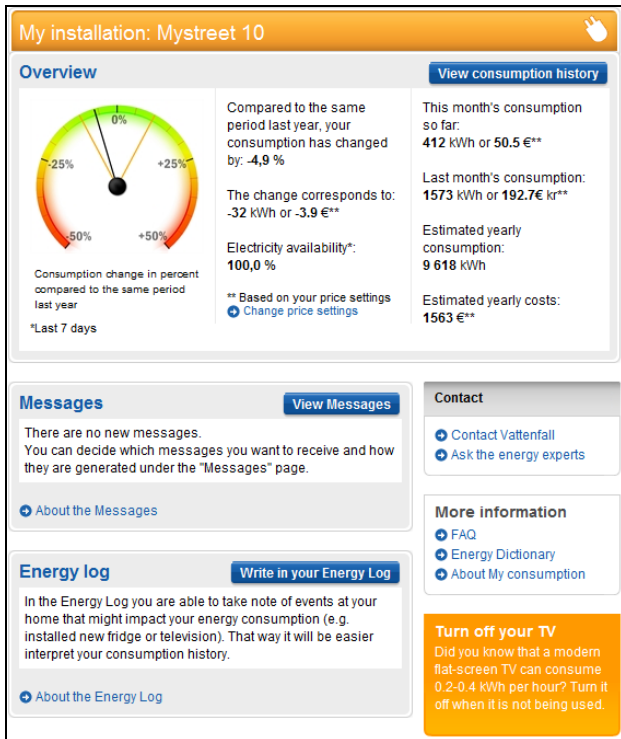


Fig. 1. Sample overview page of a customers' consumption (translated into English, original text in Swedish)

Graph tool

The main tool for a more detailed analysis of the customers' consumption was the dynamic and flexible graph tool that could be used to show consumption in different resolutions (from monthly values for a whole year to hourly values for one day). The graph tool could also compare the consumption of different time periods, as well as with the outdoor temperature from the nearest official metering point.

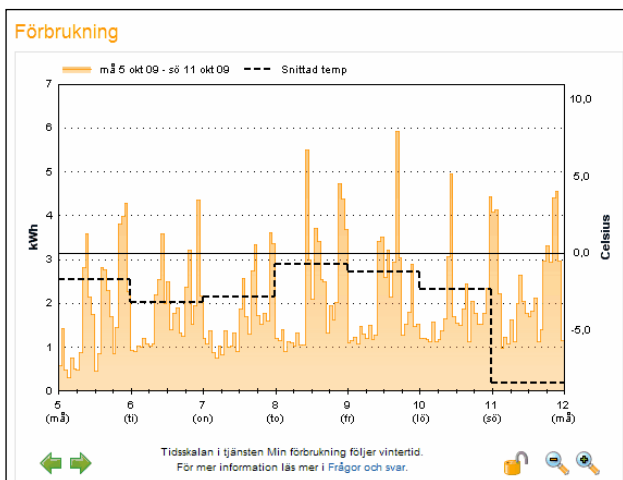


Fig. 2. In the most detailed level the system shows hourly consumption values, here during one week with a combination of outdoor temperature (text in interface in Swedish)

Energy log function

The system also included a log function to be used at the customers' free choice. The idea was to give customers the possibility to make notes on certain days for later follow up. They used it when they had influenced their consumption pattern more than usual. This could either be larger changes like starting date for the new heat-pump or just that they had a big party.

Message functions

To be able to keep track on changed consumption patterns, it was possible to set a threshold consumption level. Another message function in the system was the outage information. This informed the customer about all outage periods with both starting and ending time.

Price calculator

Many customers find it easier to measure their consumption in cost rather than in kWh, therefore the system was able to present the consumption in Swedish Kronor (kr).

Energy experts

Vattenfall offers all visitors on the Vattenfall web site to contact the Energy Advisory team. This service was also included in the CIP application, giving the customers opportunity to get an in-depth analysis on consumption related questions by providing the experts hourly consumption data.

PILOT EVALUATION

Pilot customers

This was a large pilot including customers from both different parts of Sweden as well as different customer categories with different electricity consumption patterns. Table 1 shows the breakdown between the various customer groups.

CONSUMPTION (KWH/YEAR)	NO. IN TRIAL	COMMON CUSTOMER PROFILE
1500-5000	322	Standard apartment
5000-10000	506	Large apartment or house with non-electrical heating
10000-15000	690	House with heat pump or other additional non-electricity heating (e.g. fire-place)
15000-50000	859	House with electrical heating
Small Business customers	77	Mixed; shops, hairdressers, co-operative building societies etc

Table 1. Pilot customers divided into consumption groups for private and one group for small business customers

Customer evaluations

The evaluation period was running for 12 months from March 2009 until Feb 2010. The goal of the long evaluation period was to give the customers the opportunity to use the system during one winter period when the consumption is much higher mostly related to the cold weather.

Since the pilot lasted for a whole year it was also assumed that a more long-term use pattern could be detected if the project left the customer alone as much as possible. Therefore the customers were only contacted for the evaluations and one upgrade after the summer. Even though the invited customers were randomly selected it is not possible to draw statistical conclusions regarding the whole customer segment since only interested customers volunteered to participate.

PERIOD	EVALUATION	SCOPE
After 2 months use	Large customer questionnaire and usage statistics	General interest in system
After 6 months	Small customer questionnaire	Pricing of product
After 8 months use	Large customer questionnaire and usage statistics	Follow up on long term use and interest
After 11 months	Conjoint analysis	Pricing of product
After 12 months	Small customer questionnaire	Follow up of final comments and interest in future pilots

Table 2. List of evaluations

To get some early feedback both regarding the application and possible technical issues, the first evaluation was done after about two months use of the system. Based on that evaluation the project made some minor changes in the system regarding the graph tool e.g. to support colour-blind customers better.

After about six months the first price evaluation was made trying to identify the potential price the customer was willing to pay for the product.

The second full evaluation was done after about eight months. The focus was then to analyze both the customer interest over time, both by analyzing the usage statistics as well as their rating of the functions in a questionnaire. The two evaluations included very similar questions since the aim was to measure changes in customer interest over time. It was assumed that the first evaluation would include first time use experience while the second would better reflect a normal future use of the system.

Finally a conjoint analysis was made in the end of the pilot with one targeted customer group. The focus in this analysis was to find out potential price level for the product.

The findings in the evaluations gave valuable input regarding customer interest in the different functions included. The overall customer satisfaction with the product was very good.

Average use of system

The use of the system was measured during the entire project. The project had no real information in advance on what could be expected, but guessed that people would use it quite frequently in the beginning and later on rather as a follow up tool when checking up on received messages from the system or after getting an invoice from Vattenfall. This guess was quite accurate, there was an initial peak when all

customers tested the system and later it levelled out. The interesting thing is that the level then was steady for the whole pilot period, meaning that customers actually kept on using the system regularly.

The customers did not have a very specific usage pattern when it comes to when during the day or which day of the week they used the system. There were minor login peaks identified during the morning and the evening. When looking at weekdays the customers seemed to prefer the beginning of the week a bit more than the other days, the usage during weekends was surprisingly low.

By looking at the average connection time in the system a hint was given on how much they were exploring the system. Since the average connection time was about four to five minutes and the hits on the graph page was very high it can be assumed that they actually did browse around quite a lot.

Primary customer profile

A primary customer profile has been identified based on the registered pilot group and the information gathered in the evaluations. It is a male, living in a house with no children living at home. This is not so surprising since he has a larger consumption than customers living in apartments and generally has more interest in technology than his female counterpart.

Customer comments

The evaluation has also collected many interesting comments from the customers. Generally they were very positive about the system and gave a lot of valuable feedback.

The most common comments were

- Customers with some electricity heating appliance in the household would like to view this heating consumption separately from the total consumption.
- The customer is uncertain whether his consumption is normal compared to other similar households.
- The data need to be both delivered promptly and also be accurate. Otherwise the customers trust in the system decrease and they stop using it.
- Add-on features give the customer more tools for follow up and analysis which would increase the interest to use the system on a more regular basis.

Important issues for a large scale implementation

The lesson learned regarding implementation issues in this large pilot is to have focus on delivery time and quality in consumption data. If that fails it jeopardizes the reliability of the entire system, which eventually will have negative influence on the company brand.

To be able to achieve excellence in delivery and quality of data, the following are essential:

- The infrastructure must be able to handle the increased volume of data all the way from the meter to the system without major delays. This can not be taken for granted since the infrastructure requirements originally were to deliver one meter value per customer and month for exact billing, and now need to deliver 24 values per day. Therefore some verification and performance tests need to be done before launch.
- From the company side it is important to have relevant tools for follow up and verification of data delivery and quality/accuracy to be able to act proactive instead of waiting for customer complaint before acting.
- A future Nordic retail market model based on single point of contact for the customer would make it essential to provide efficient solutions for data delivery and exchange between customers' different Distribution and Sales companies.

After the pilot

While the pilot was still running in Sweden the Finnish part of Vattenfall decided to roll out a product based on the findings from the pilot application. The first version of their "on-line service" is now available for all Vattenfall Distribution customers in Finland. The functions so far are focusing on presentation of hourly data to fulfil upcoming legislation.

BUSINESS CASE

The customers' willingness to pay for this kind of system was one important question to investigate. The first survey was made after about 6 months through a small questionnaire with a rather straightforward question regarding how much they would consider paying per month for a system like this. The second survey was a more structured conjoint analysis in the final phase of the project, comparing different and more fixed alternatives.

These analyses show an interest to pay in some customer groups while other customers expected that a large company like Vattenfall should provide these services free of charge.

CONCLUSIONS

A large pilot like this gives a lot of valuable input about customers, both by looking at evaluation results and statistics, but perhaps best of all by reading all engaged comments they have provided in the surveys.

Customer support has been less needed than expected. A tool like this, with high usability and enough on-line information, would - if implemented in large scale - probably put less pressure on Customer Service support at billing dates, since customers could find information about their consumption on-line.

There is quite a large customer group that has a keen interest in their electricity consumption for different reasons. One to save money, the other is more interested in climate saving and yet another one wants to follow up on changes in energy consumption patterns. Then there are of course also customers that want to verify the electricity bill. It is important for Vattenfall to satisfy all these customer groups.

Even if the smart meter infrastructure is in place, there are a number of things to consider regarding the data collection. Collection of high resolution data puts high demand on communication solutions, storage areas and supervision of data delivery, quality and assurance.

Last but not least the customer integrity question needs to be mentioned. A few years ago the customer consumption information was limited to annual consumption, based on one manual meter reading per year. Now, when reading hourly values it is possible to conclude more than wanted, e.g. if the customer is at home or not. Managing detailed data like this will of course put very strict requirements on systems regarding data security solutions.