

Beste lezer,

Voor u ligt een samenvatting van mijn master thesis “Nieuwe kwesties in het analyseren van de informatiebehoeften van gebruikers voor een feedback systeem voor energie gebruik: een kwalitatieve studie naar microgeneratie, bedrijven en de robuustheid van de MoSCoW-methode.” Deze samenvatting is bedoeld voor LochemEnergie en in het bijzonder de deelnemers van het onderzoek. Zonder de deelname van deze 15 geïnterviewden en de andere betrokkenen van LochemEnergie had dit onderzoek niet plaats kunnen vinden. Dank voor jullie deelname en inzet!

Ik wens u veel leesplezier!

Suzanne Beltman

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Kernpunten onderzoek:

- Informatiebehoeften analyse voor een feedback systeem betreffende energie opwek en gebruik voor LochemEnergie.
- Toevoeging aan de wetenschappelijke literatuur betreffende drie nieuwe kwesties: (1) microgeneratie, (2) feedback voor bedrijven en (3) de robuustheid van de MoSCoW-methode voor het rangschikken van de informatiebehoeften.
- Uitgebreide beschrijving van drie toekomstige gebruikersgroepen van het feedback systeem.
- Weergave van de attitudes van toekomstige gebruikers ten opzichte van het afstemmen van opwek en gebruik, energie-uitwisseling, elektrisch vervoer, een competitie en een energie besparingsspel.

Doel van het onderzoek. Het doel van het onderzoek was een analyse van de informatiebehoeften van de gebruikers van een feedback systeem voor energiegebruik en het lokaal opwekken van die energie (microgeneratie) in huishoudens. Hierbij werd ook gekeken naar de verschillende informatiebehoeften van verschillende gebruikers groepen die konden worden onderscheiden binnen de 15 huishouders. Daarnaast konden aan de hand van deze behoeften analyse drie nieuwe kwesties, die nog nauwelijks tot niet eerder onderzocht waren, onderzocht worden. Hierbij gaat het om (1) de specifieke aard van LochemEnergie: microgeneratie, (2) de verschillen tussen de informatiebehoeften van huishoudens en bedrijven en (3) de robuustheid van de MoSCoW(Must have – Should have – Could have – Won't have)-methode voor de rangschikking van de behoeften. Het laatste doel was het vaststellen van de attitudes van LochemEnergie deelnemers ten opzichte van de volgende onderwerpen: afstemmen van opwek en gebruik, energie-uitwisseling, elektrisch vervoer, een competitie en een energie besparingsspel.

Methoden. Voor het onderzoek zijn 15 toekomstige gebruikers van het feedback systeem geïnterviewd over hun informatiebehoeften voor dit systeem. Deze interviews zijn vervolgens getranscribeerd, gecodeerd en hieruit zijn uiteindelijk de behoeften naar voren gekomen. Deze behoeften zijn daarna gerangschikt in 4 categorieën door gebruik te maken van de MoSCoW-methode. Deze 4 categorieën waren, op volgorde van belangrijkheid: *Must haves*, *Should haves*, *Could haves* en *Won't haves*. Vervolgens konden de 15 huishouders ingedeeld worden in 3 verschillende gebruikersgroepen en werden de informatiebehoeften van deze 3 groepen vergeleken. Deze gebruikersgroepen werden samengevat in 3 persona's. Een persona wordt weergegeven in de vorm van een fictief persoon, met een verhalende omschrijving en een passende foto. Hierna werden de resultaten van het huidige onderzoek vergeleken met een bijna identiek onderzoek dat gericht was op de informatiebehoeften van bedrijven voor eenzelfde feedback systeem. Verder werd er gekeken naar de robuustheid van de MoSCoW-methode voor het rangschikken van de behoeften. De cut-off waarden, die bepaalden of een behoefte bijvoorbeeld binnen de *Must have* of de *Should have* categorie viel, werden op 3 manieren veranderd om vast te stellen of dit invloed had op de uiteindelijke rangschikking van de behoeften. Ten slotte werd het aantal positieve, neutrale en negatieve attitudes ten opzichte van de eerder genoemde onderwerpen voor de attitudes vastgesteld.

Resultaten. De indeling van de behoeften in de 2 belangrijkste MoSCoW categorieën kunt u vinden in tabel 1. Er is onderscheid gemaakt in inhoud en design behoeften.

Tabel 1. Indeling van de behoeften in de 4 MoSCoW categorieën.

| Inhoud | | Design | |
|----------------------------------|----------------------------|--|---------------------------------|
| Must haves | Should haves | Must haves | Should haves |
| Gebruik | Advies/tips | Applicatie op meerdere apparaten | In 1 oogopslag |
| Besparingen | Gas gebruik | Zoomfunctie | Praktisch/ makkelijk in gebruik |
| Opbreken per apparaat | Vergelijkingen met anderen | Display invloed | Systeem simulatie |
| Vergelijkingen met eigen gebruik | Indirect | Automatisch afstemmen opwek en gebruik | Alert/ waarschuwing |
| Direct | | Staafdiagram voor vergelijkingen | Grafisch |
| Opwek | | | Grafieken |
| Afstemming opwek en gebruik | | | Staafdiagrammen |
| Energie-uitwisseling | | | Taartdiagram voor opbreken |
| Elektrisch vervoer | | | Lijn diagrammen |
| Terugkijken | | | |
| Frequentie on demand | | | |

Huishoudens werden samengevat in drie persona's met verschillende informatiebehoeften. Tabel 2 op de volgende pagina geeft een overzicht van de kenmerken van de drie persona's en de belangrijkste verschillen in informatiebehoeften. In de bijlage vindt u de complete persona's in het Engels zoals opgenomen in de thesis.

Tabel 2. Overzicht van kenmerken en behoeften van de 3 persona's.

| The innovator environmentalist | The technology user | The saver |
|---|---|--|
| Kenmerken | | |
| Meeste kennis energie besparen | Meeste kennis technologie | Minste kennis |
| Al (lang) bezig met energiebesparen en opwekken | Veel vertrouwen in technologische oplossingen | Wil zowel geld en energie besparen |
| Milieu belangrijkste reden deelname | Milieu belangrijkste reden (minder dan voor innovator environmentalist) | Kosten besparing is de belangrijkste reden voor deelname |
| Behoeften | | |
| Toegankelijk feedback systeem | Vergelijkingen met anderen | Indirect |
| | Systeem interventie | Energiebesparingspel |
| | Smart grid | Systeem simulatie |

Een vergelijking tussen de behoeften voor huishoudens en bedrijven liet zien dat bedrijven de voorkeur geven aan uitdrukkingen in geld. Huishoudens gaven de voorkeur aan gedetailleerde, specifieke, on-demand feedback. Verder wilden ze meer invloed kunnen uitoefenen op de interface display en wilden ze in kunnen zoomen in verschillende lagen van het systeem. Verder liet de studie zien dat veranderingen van cut-off scores leidden tot veranderingen in MoSCoW rangschikking voor maximaal 5.9 procent van de inhoud behoeften.

De attitudes waren erg positief ten opzichte van afstemming van opwek en gebruik (93%), automatisering van die afstemming (80%), energie-uitwisseling (100%), elektrische vervoer (100%) en netwerk optimalisatie met behulp van elektrisch vervoer (93%). Voor automatisering waren er naast de vele positieve attitudes ook een aantal sterke negatieve attitudes (13%). De attitudes richting een competitie (positief 53%, negatief 47%) en een energiebesparingspel (positief 60%, negatief 40%) waren erg verdeeld.

Conclusies. De informatiebehoeften voor energie gebruik bevestigen de behoeften gevonden in eerder wetenschappelijk onderzoek. De behoeften voor het eerste nieuwe onderwerp (1) microgeneratie zijn een nieuwe bijdrage aan de wetenschappelijke literatuur. Verder zijn verschillende soorten feedback geschikt voor verschillende soorten gebruikersgroepen. Dit geldt ook voor het tweede nieuwe onderwerp: huishoudens en (2) bedrijven. Ten slotte het laatste nieuwe onderwerp (3) de robuustheid van de MoSCoW-methode: de resultaten zijn een veelbelovende eerste stap voor het vaststellen van de robuustheid van deze methode. Er is echter meer systematisch onderzoek nodig om betrouwbaardere uitspraken over de robuustheid te kunnen doen.

Aanbevelingen voor een feedback systeem voor LochemEnergie. Bij het ontwerpen van een feedback systeem voor LochemEnergie zal er rekening mee moeten worden gehouden dat verschillende feedback geschikt is voor verschillende gebruikersgroepen binnen huishoudens maar ook tussen huishoudens en bedrijven. De uitgebreide beschrijvingen van de gebruikersgroepen en hun informatiebehoeften beschreven in de thesis kunnen hier een goede

leidraad voor vormen. Dit laatste geldt vooral voor microgeneratie, aangezien dit niet in de bestaande literatuur te vinden is. Als laatste is voorzichtigheid geadviseerd bij het implementeren van geautomatiseerde systemen, competities en energiebesparingspellen. Automatisering kan enorm gewaardeerd worden door gebruikersgroepen die technisch zijn ingesteld, maar het kan ook weerstand oproepen bij andere gebruikersgroepen.

Bijlage

Persona 1: The innovator environmentalist

Emmy, 58 years old, has a small advertisement company and an at home office in a small building in her backyard. She and her husband are the parents of three children, of which only the youngest son still lives at home. She is really interested and involved in energy saving, green energy and sustainable developments. She joined LochemEnergie because she really believes that together with same minded people,



she can achieve more than alone. She joined LochemEnergie in an early stage, has always been involved, attended meetings and has a lot of knowledge of LochemEnergie. She already monitors her energy generation and consumption to some extent and is really aware of her consumption. Yet, she would like a feedback system that is more detailed and tailored than the one she uses now.

On a typical Saturday morning in March, Emmy gets out of bed and dresses up with an extra warm sweater and extra warm pair of socks, because she deliberately turned off central heating to save energy. This is just one of the many energy saving actions she performs on a day. Next, she looks out the window and sees the sun is shining brightly, and she joyfully thinks about all the green energy the solar panels on her roof will generate today. The solar panels on the roof have been there for almost ten years now and Emmy has worried about the environment and the depletion of fossil energy sources for almost all her adult life. For her, this was the reason to purchase solar panels, completely isolate the house and office and to behave energy efficient. She would have done so even if there would be no monetary benefits in the long run. Her goal is to become self-sufficient in energy-supply and to be no burden to the environment. She is really close to reaching this goal, as her household almost generates as much energy as it consumes. She realizes that automation of the matching of energy generation and consumption can help save energy, so she is in favor of this automation. Yet, she finds it hard to imagine what the possibilities of such a system could be, because she has not much knowledge of technical systems. Possibilities such as system intervention scare her to some extent, because she finds them too intrusive. She wants to stay in control of her own domestic appliances.

Speaking of which, one will not find a dishwasher in Emmy's household, so after breakfast she does the dishes by hand. She does have a laundry machine, which she tries to use only after checking whether the solar panels generate enough energy at that moment. And when the laundry is done, clothes will be hanged outside to dry in the sun. After finishing the household chores, she sits down to read the paper and other articles on sustainable energy developments. Although she already has a substantial amount of knowledge on energy saving, she tries to stay up to date with present developments. During the reading session, her son turns on the TV and the computer at the same time. This works on her nerves, because she really tries to educate and promote energy saving among her children. Nevertheless, they still use a lot of electric devices and forget to turn off the lights

every now and then. She tries to set an example, not only to her children, but to as many persons as possible. To inspire others, she considers placing a sign in her front yard that displays the amount of green energy her solar panels have generated during that day.

Although Emmy is willing to make a lot of behavioural compromises, she also tries to balance (in home) comfort and sustainable energy consumption. She owns a computer, laptop and smart phone, because she simply wants to go along with developments. For example, when she got her smart phone last year, she found it rather difficult to find out how it worked and what its functions were. But nowadays, she finds it not that difficult to use her smart phone. On some occasions she uses them for her own amusement, but mostly for communication and information. She expects to use these devices almost everywhere in the future.

As she continues her day, during the afternoon, Emmy deliberately takes her bike instead of the car and goes out to meet some of her friends and to do some grocery shopping. In the evening she cooks dinner, using as little energy as possible. After dinner, she watches a movie with her husband and son on their big but energy-efficient TV. And finally, she returns to bed, after turning down all lights and shutting off all other electric appliances.

Persona 2: The technology user

Tom, 52 years old, works as head of the energy-department of a large company. Together with his wife, he lives in a nice house in Lochem. He recently joined LochemEnergie because he thinks it is a good local initiative that might help him to reach his goals to become self-sufficient in energy-supply, to be independent and to move away from large energy companies with too much power.

When Tom woke up this morning and saw the sun shining brightly, he immediately started thinking about the solar panels that he was going to rent through LochemEnergie and he felt content with his decision to do so. He is particularly interested in local energy generation, the smart grid and other technological developments LochemEnergie intends to employ. Over the last couple of years, he has gained a lot of knowledge about these technologies.

After breakfast he sat down on the couch with his iPad and read an article regarding the depletion of fossil energy sources and the environment. During this, he realized that although the monetary benefit also played a role, sustaining the environment was the main reason for him to want to generate his own local and green energy and to conserve other forms of energy. Tom also realized that with all his knowledge about energy saving and technologies, he still uses too much fossil energy and does not perform consistent actions to conserve this energy. He really thinks that he should save more energy and when his wife sat down next to him, he told her the following: “I really think that when we receive our energy feedback system and the smart grid is working, we should start behaving more energy-efficient. Technology will help us to do so and bring great advantages.” His wife smiled and



agreed with him.

After reading, Tom continued working on isolating his own house, which he usually does in his spare time. He wondered whether he should rebuild his house so that central heating occurs through the use of electric energy instead of gas. He thinks that when all electric energy he uses is green and locally generated, he would have no problem using more of this type of energy instead of using less energy through energy saving behaviour. He thinks that as long as it is green, it will contribute to a sustainable environment.

Then, his smart phone started ringing, but before he could answer the phone the battery died. Tom got a little irritated and wondered why the smart phones of this day were not equipped with little solar panels. That would make smart phones much more practical to use, and in the same time it would also support the conservation of the environment.

After working on his house, Tom sat behind his computer and looked up some information on remodeling houses. He uses his iPad, smart phone and computer more for private consumption than work related consumption. He did start to use these devices for his work and because they make his life easier and more efficient. Tom really thinks he has a lot of skills and knowledge about these devices and that this influences his usage of these devices a lot.

Later that day, Tom attended a LochemEnergie meeting that was aimed at informing its members about the smart grid project. He has great curiosity, interest and trust in the smart grid and other future technical developments that he thinks will help him achieve his goals. During the meeting, Tom was told that the smart grid will bring automation into the matching of energy generation and consumption. Tom responded enthusiastically, by stressing the fact that he wants to be a “user” of the system in the first place and that the system should support or even facilitate his energy consumption behaviour. He highly values possible intelligent features of a feedback system, such as little user action, automation and system intervention. During this meeting Tom also expressed his interest in matching the total amount of generated for all members of LochemEnergie, with the energy consumption of these people. He would really like for LochemEnergie to keep its members informed and updated about the success and progress of the cooperation. And this success can only be defined in term of the matching process of the entire cooperation and not just that of individual households.

When Tom came home that night, he enthusiastically told his wife about the meeting. And finally, he went to sleep, after he had checked his iPad and smart phone for interesting news and messages.

Persona 3: The saver

Andy, 47 years old, is employed in a small enterprise in Lochem. He, his wife and two young daughters live close to his work. He joined LochemEnergie last year because he thinks it is a good initiative and that it will help him to reach his main goal: saving energy and money.

This morning Andy woke up and heard his new-born child was crying. He went to her room and she stopped crying. He sat down next to her bed and looked out of the window. It looked like it was going to be a rainy and gloomy day again. He started thinking about the solar panels he decided to rent. The roof of his house faced north, so it was not suited for installing his own solar panels. Although Andy would have rather bought his own solar panels, he is very content with the fact that



LochemEnergie has provided him with the alternative to rent them instead. But with this type of weather all week, he would not have generated much energy even if his roof was facing south.

After breakfast, Andy and his wife went to their good friends and neighbors who also joined LochemEnergie and they had an interesting conversation with them about their motives to generate green energy and to save energy. Of course, the environment and contributing to sustainable energy consumption were important reasons for Andy to rent these solar panels and to save energy. Yet, he was really clear about the fact that the most important reason was the monetary benefit that came along with it. Andy clearly expressed that: “if his own green generation would be more expensive, he would not have participated.” In addition, Andy also admitted that compared to his neighbors, he does not perform a whole lot of energy saving actions. He drives his bicycle to work because he lives nearby and bought an energy label A refrigerator last year, but that was it.

Then, they started talking about the smart grid and system automation. Andy responded really positive about making the matching of generation and consumption more automated, as long as it would lead to more financial benefits. He was not quite sure about how far this automation should be taken, he was not really positive about real system intervention, as it may be too intrusive.

When they got home around lunchtime, Andy decided to make a nice lunch for his family. Inspired by the previous conversation, he wanted to use as little energy as possible. But during this, he realized that he had not that much knowledge on how to save energy and behave energy-efficient. After lunch, he talked about this with his wife and they were both really motivated to gain more knowledge and insight and to learn how to save more energy.

After a delicious lunch, Andy checked his energy meter and wrote down his energy consumption from last week. He started doing this a month ago, because he realized that he did not have an accurate picture of his current energy consumption. In order for him to use less energy, he needed a clear picture of his energy consumption. Checking his regular energy meter weekly was a first start, but he would really like a feedback system that provides him with accurate and detailed feedback on his energy generation and consumption.

He would also like for that system to teach him to use energy in a smarter way. Because his knowledge is not optimal, he would like to receive energy saving tips and advice to really boost his knowledge and energy saving actions.

Later that day, after putting his oldest daughter to bed, Andy sat down with his laptop by the kitchen table and decided to look up some extra information about what he had talked about all afternoon. He also used his smart phone to communicate with some of his friends. For relaxation, Andy played his favorite game on his laptop. Andy really likes playing games and he started thinking about an energy saving game. If someone would design an energy saving game that was educative and fun, it could really provide him and his family with more knowledge and insight on energy saving behaviour. It would also be fun and educative for both adults and young children.