End-user Research in PMCII

PowerMatching City

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Groningen Energy Summer School, 20-8-2014
Today:

End-user research in PowerMatching City II (june 2013 – june 2014)

Results of quantitative and qualitative research


- Presentation ‘Behave 2014’ in Oxford.

Research process
PMCII

40 households

decentralized energy sources (PV and micro CHP), hybrid heat pumps, smart appliances, smart meters, and in-home displays
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2 Energy Services:

Smart Costs Savings
Feedback on Costs

Together More Sustainable
Feedback on percentage of consumed energy that is produced locally
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3 types of Control:

Automatic  
hybrid heat pump or micro CHP

Smart  
washing machine

Manual  
general appliances
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Questions:

(1) How do end-users experience several types of control (automatic, smart, manual) and feedback (costs vs. sustainability)?

(2) Do end-users shift their consumption to off-peak hours?

(3) Which kind of feedback and control is effective and for whom?

pro-environmental values, egoistic values, pro-social values

(e.g., De Groot & Steg, 2008, 2009)
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Theoretical model:

3 measurements:

VALUES → ATTITUDES → INTENTION → BEHAVIOR
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**Timing:**

- **Initial test** (Time 1)
- **Questionnaire** Time 2
- **Concluding test** (Time 3)

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<tbody>
<tr>
<td><strong>Introduction Energy Services</strong></td>
<td><strong>Participant Session 1</strong></td>
<td><strong>Participant Session 2</strong></td>
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Planned research:

1. Pretest:
   - Values
   - Representativeness PMC-group (reference: Essent-customers)
   - Expectancies of Energy Services

2. Time II
   - First experiences
   - Behavior

Reality:

Results:

2. Time II:
   - Experiences: little bit later…
   - Behavioral data: missing data, smart washing machines were not installed

Results:
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- End-users were positive about the project
- Energy services ‘important’ and ‘sustainable’;
- SCS more positive than TMS;
- Reliability of Energy Services was judged as ‘low’;
- “My energy monitor/heat-pump/micro-CHP does not work”.

=> What do you do?
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What do the end-users mean?
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Participant session:

- Share the first results
- Discuss the results in subgroups
<table>
<thead>
<tr>
<th>Expectancies more positive than first experiences</th>
<th>Reliability low?</th>
<th>“My Energy Monitor does not work properly.”</th>
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<tbody>
<tr>
<td>Do you recognize this?</td>
<td>Do you recognize this?</td>
<td>Do you recognize this?</td>
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<tr>
<td><strong>Yes</strong></td>
<td><strong>Yes</strong></td>
<td><strong>Not exactly…</strong></td>
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<tr>
<td>Because.....</td>
<td>Because.....</td>
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<td>But...</td>
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<tr>
<td><strong>Automatic and Smart Appliances switch on at expensive / not sustainable moments</strong></td>
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**Adjustments:**

=> Are there problems with the system?

=> Communication

=> Extra measurement: Do end-users believe that the problems are solved?

=> Concluding test (Time 3)
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Plan B:

Vision on the project does not change, focus of the research does

=> Focus on trust (extra measurements)
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Results concluding test and second session

Attitudes towards Energy Services:

- TMS
- SCS

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<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
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<tbody>
<tr>
<td>TMS</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>SCS</td>
<td>5</td>
<td>4</td>
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Results concluding test and second session

Attitudes towards Energy Services:

• High correlation between T1, T2, T3

• Even though participants valued Sustainability more than Costs: SCS more positive than TMS

“Feedback in Euros is more tangible than feedback in ‘leaves’”

Also, SCS more actively involved:
- looked at their monitor more often
- shifted regular appliances more often
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Results concluding test and second session

Attitudes towards automatic, smart, manual control:

- Time 1
- Time 2
- Time 3
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Results concluding test and second session

Attitudes towards automatic, smart, manual control:

- Automatic and smart DSM were most popular (least effort);

- Important boundary condition: trust;

- Smart DSM was judged most positive, because it offers the opportunity to “take back control into your own hands”;

- Shifting demand manually is most rewarding;

- Participants perceived their return of the energy service from the three methods of control as rather equal.
Summary research results:

1) Feedback on cost reduction is valued most;

2) Automatic and smart control are most popular, but manually controlling appliances is more rewarding;

3) Experiences and behavior of end-users depended on trust in both technology (ICT infrastructure and connected appliances) and the participating parties.
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Other research results:

1) End-users preferred to consume self-produced energy, even when it is not the most efficient strategy to follow;

2) We were not successful in establishing a community. Trust was relatively low between end-users:

   “What if my neighbour decides to use my sustainably generated energy for his Jacuzzi?”

3) Once trust is violated, it is very hard to win it back;

4) Two thirds would choose Smart Cost Savings now.
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Lessons learned from the research process:

• ALWAYS stay in close contact with the end-users!

• Communicate, communicate, communicate:

  “When things go wrong, communicate that things go wrong”;

• Be flexible, which can be difficult when the project is not your main focus, but your (PhD) research is;

• Experience with many different research methods is useful.
Manually shifting appliances requires effort, but it feels good!

I value the community, but what if my neighbour uses my sustainable energy for his Jacuzzi?

Feedback in Euro's is more tangible than feedback in 'leaves'

“I do prefer feedback on sustainability... but in December I would like to know the costs”
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