User Sentiments Towards Smart Grid Flexibility A survey of early adopters' attitude towards allowing third parties to control electricity use in households Marius Rohde Johannesen, Lasse Berntzen, Boban Vesin, Qian Meng,

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Presenters

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Marius heads the USN research group "Management Information Systems".

Marius teaches web development, project management, data analytics, communication and digitalization.

His research is focused on smart cities, digitalization of the public sector and political communication.

Lasse Berntzen

Professor,

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Lasse is has been and is doing research on the digital society, egovernment, e-participation, and "smart cities". He is currently focusing on "smart energy" through two European research projects.

Lasse teaches in the areas of IoT, business analytics, and data mining.

Introduction

- Energy markets are in transition from fossil to renewable
- Renewable energy has a more varying output (dependent on wind and sun)
- Need for smart grid and flexible solutions to stabilize the grid
- Thus, we examine early adopter sentiments towards smart grid flexibility

Literature Review

Smart grids and smart homes

Adoption, ease of use, and diffusion

Research Approach

- Pilot study
- Testing ideas on early adopters
- Data sources
 - Two online discussion forums
 - Four Facebook groups
- Self-selection
- 209 answers, 52 answers to open ended questions

Findings

Demographic characteristics of early adopters

Attitudes towards technology, existing smart technology

Incentives and motivations

Qualitative concerns

Demographic Characteristics of Early Adopters

209 respondents

95% male

Mostly 30-60 years age group

75% own houses, 13% own apartements

High incomes compared to average

Adoption of Technology

"I adopt new technology"	Fully agree	Somewhat agree	Somewhat disagree	Disagree
Quicly	58.4	38.8	2.4	0.5
If it is easy to use	59.1	33.2	6.7	1.0
If it is useful to me	79.9	30.1	0.0	0.0
If the price is right	71.8	25.4	2.9	0.0
Friends and family asks my advice about technology	57.2	36.1	5.3	1.4

Preferred Smart Home Setup

Purchase individual components and build my... Buy an off-the-shelf solution, some setup... Buy an off-the-shelf solution, no setup required 0 10 20 30 40 50

Smart Home Products Owned



Incentives

I am willing to let outsiders	Annual savings						
	< €30	€30-79	€80- 119	€120- 149	>€150	Not at all	
Use my EV's battery to balance the grid	2.9	4.3	10.1	5.3	39.9	37.5	
Control charging of my EV	10.6	9.7	14.0	6.3	31.4	28.0	
Control heating in rarely used rooms	11.1	7.7	13.0	5.3	16.8	46.2	
Control heating in frequently used rooms	4.8	4.8	7.7	3.8	19.2	59.6	
Control my water heater	12.0	4.3	16.7	5.3	26.3	35.4	

Importance of Statistics and Analytics



To be able to monitor and analyze power consumption (and production)

Key Findings

- The cost of grid access and use is a barrier
- Money first, ideology second
- Users are happy to invest in power saving smart homes but prefer to be in control
 - Lack of trust
 - Privacy and security concerns
 - Technology not perceived as mature
- Social aspects.

Comments from Respondents

Comments regarding the cost of grid access and use + Money first, ideology second

- "The grid tariff in its current and planned form is the major obstacle to a more aggressive approach to cutting electricity consumption"
- "Now we are threatened we might have to pay the DSO for the electricity we supply to the grid from our solar panels"
- "I can easily upgrade my home so I can charge my two EVs with a total 14kw during the two hours at night when the grid is least used, but I have no incentives for that [with a tariff based on maximum kwh used]"

Comments from Respondents

Comments regarding control and trust

- "Energy companies will never be allowed to control anything in my house. They have showed time and time again they can't be trusted, with their hidden terms and conditions"
- "I don't trust them. What if something goes wrong?...and if the system is able to cut costs, that won't get back to consumers "
- "privacy issues...if something is to be controlled, or data stored, who has access and for what purpose? How are data kept?"

Comments from Respondents

Comments regarding social aspects

- "Those with a lot of money can afford to do all kinds of things, and are rewarded with money for doing it, but others can't afford to invest in power saving technology»
- "It is just as important to inform and visualize the greater good, for example by creating a community for those who allow the DSO to take control and show what this effort does in terms of energy saving"
- "I would like to see my carbon footprint and how [smart technology] contributes to a more green and sustainable consumption of electricity"

Conclusion and Future Research

- Lots of interest in the topic of flexibility (200+ replies in a few days)
- Main finding:
 - Smart home users are interested in saving money by controlling household energy use, but they are not very willing to allow third parties to take control
 - Monetary incentives most important and needs to be large enough that users find it worthwhile
- Possibilities for future research:
 - Bringing down the cost of grid access, use and smart home technology
 - Incentives business models that work for both prosumers, DSO and TSO
 - Technologies that allow users to be in control, but still offer flexibility
 - Social aspects of adoption, including sustainability and gender differences