Integration of Smart Grid Technologies in Households

How Electric Vehicles and Dynamic Pricing change Social Practices in the Everyday Life?

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Integration of smart grid technologies in households – how electric vehicles and dynamic pricing change social practices in everyday life

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Abstract

This article considers the interplay between new smart grid technologies and households' everyday practices. The research focuses on how Electric Vehicles and Dynamic Pricing influence Danish households' everyday life and how these technologies constitute and change routines and practices of consumption.

The basic assumption is that new technologies influence social practices in households' everyday life. The empirical material, mainly consist of qualitative interviews with Danish households who had test-driven Electric Vehicles and participated in Project Dynamic Pricing, is analysed with the analytical concept offered by the Social Practice Theory.

Overall, the case-study demonstrates that the smart grid technologies influence the 'way of driving' and changed the temporal patterns of consumption in the families during the test period. The investigation contribute to a more complex and multi-facetted consideration of the interplay between households' social practices and new smart-grid technologies and thereby helping to fill out the lack of research on the integration of peak-shaving technologies in the end-user design.

Introduction

Current energy systems face the challenge of including more renewable energy sources (RESs) in their supply. To manage the transition to a more sustainable energy system based on fluctuating energy production, a new highly complex, self-balancing energy system called 'Smart Grid' has been initiated. Smart grid is a process of defining and developing intelligent control technologies to control and coordinate flexible consumption in order to maintain a balance between production and consumption in the overall electricity system.

RESs increase the demand for new consumption patterns by the fact that photovoltaics (PVs) and wind power are fluctuating, dependent on the availability of sunshine and wind. In Denmark, wind power is put forward as a main RES and is expected to increase substantially by 2020. The typical highlighted future scenario of a critical grid load in Denmark is the particular (consumption) peak between 5–7 pm in the afternoon. To solve this challenge, the intelligent control technologies are envisioned as a possible solution to 'peak-shave' through flexible electricity management in the households.

In general, the establishment of smart grid has focused on technical and economic challenges and advantages (Christensen et al. 2013), but also user involvement and user-oriented innovation have emerged within the concept of smart grid. This perspective is pursued among consumption researchers, emphasising that social and cultural perspectives on consumption are inevitable for developing a sustainable energy system (Darby 2010, Gram-Hanssen 2011a, Gram-Hanssen 2011b, Nyborg and Røpke 2011). Hence, recent research findings show that constituted social practices are as least as important as the efficiency of technology (Darby 2010, Gram-Hanssen 2013, Gram-Hanssen 2011b, Nyborg and Røpke 2011, Axsen and Kurani 2010).

From this point of view, households and consumers are, as prominent 'actors', expected to play a more active role in order

to maintain the balance between consumption and production in the grid. Concrete examples of flexible energy production and consumption are: household-based production, their ability to store energy in batteries or by heating houses and by load management facilitated by moving energy consumption like electric heating, charging of electric vehicles (EVs) or moving laundry activities (Christensen et al. 2013, Nyborg and Røpke 2011). This investigation focuses specifically on EVs and their expected potential for maintaining a balance in the grid through load management that can either delay or forward consumption in relation to the generation of wind power in the energy system.

Through an in-depth case study, our purpose is to explore how social practices, in a particular context, are changed and constituted in households after obtaining and integrating EVs and Dynamic Pricing in their everyday. The aim is to provide some new insights into how consumption is organised and how new consumption patterns influence the social worlds of households that manage to integrate those two projects into their everyday life. Based on the conviction that cultural and social structures of everyday life are decisive elements in the transition to a low-carbon energy system, this article aims to explore: *How do smart grid technologies as EVs and Dynamic Pricing change and constitute social practices in households' everyday life?*

Methods and empirical material

CASE STUDY

The case study consisted of the two smart-grid/peak-shave demonstration projects 'Test-an-EV' and 'Project Dynamic Pricing', where 18 families from two small towns in the South of Jutland participated. Both projects ran from May to October 2012 (5 months) and were the first demonstration projects in a Danish context with participants who combined EV driving with Dynamic Pricing in their everyday life.

"Test-an-EV" is facilitated by the mobility operator CLEVER, which is owned by the utilities SE and SEAS-NVE[1]. CLEVER provides EVs through financing services, operation, advice and environmental optimisation e.g. by building a nationwide charging infrastructure network[2]. CLEVER's mission is "to create a strong synergy between environmental concerns and mobility by promoting EVs and ensuring that they are charged intelligently" (www.clever.dk). The overall aim of CLEVER is to play a significant role in developing balancing smart-grid solutions with regard to EVs (ibid.).

"Test-an-EV" is promoted as Europe's largest EV research project, where 1,600 Danish households from 24 municipalities all over the country test 200 EVs for a 3-month period. The project was launched in December 2010 and will end primo 2014. CLEVER terms the participating households who test-drive the EVs 'test pilots'. CLEVER outlined requirements for the families involved, e.g. the families must already own a car, as the project was not allowed to create more car-driving. Further, for three months of free test-driving, the test pilots were, committed to the following obligations or 'rules': daily blogging (on the website www.testenelbil.dk), to log data in a driver's log book (for each drive undertaken), installation of a load cable in their house, to share their personal experience (e.g. through official meetings) in general and to pay the expenses of their recharge at home[3]. Moreover, CLEVER installed a data logger in every test car to register battery technology, driving patterns and the EVs influence on the energy net. In other words, the test pilots were committed to a number of obligations during the test period, but at the same time they got a chance to test an EV without economic expenses (apart from the loading cost at home). In return, CLEVER gained experience and knowledge of test pilots' 'sayings and doings'. Thereby, the projects underlying conviction is emphasising that user experience and performance are highly significant for paving the way for a qualified sustainably transformation of the energy system.

As mentioned, the expected main challenge was related to the load management and charging processes. In order to level out peaks and increase the incentive to move consumption to low-consumption hours, the 18 test pilots participated in 'Project Dynamic Pricing' launched by the energy company SE. This further demo-project offered the test pilots dynamic tariffs[4] (price of the transportation of electricity in the grid) and variable hourly electricity pricing (Nord-pol's spot-electricity price). At the first meeting with the 18 test pilots from Sønderborg and Åbenraa, SE introduced three general recommendations in order "to save money and care for the environment" according to 'Project Dynamic Pricing': To move laundry activities (washing and drying) and dish washing to hours when the spot-electricity price and net tariffs are the lowest (during the night), charge electrical equipment – and not least to load EVs during the night. The purpose of 'Dynamic Pricing' was to test consumers' flexibility to move their consumption to hours with low electricity demand and high production of RES, and to increase awareness of electricity consumption in general. SE collected the quantitative data consisting of respectively hour-based recordings of the households' electricity consumption. SE's overall aim was to avoid peak loads by increasing the economic incentives and thereby changing the conventional consumption patterns.

The hourly price (excl. taxes) of the spot electricity can be found on a website[5]. The Dynamic Net tariffs were divided into four categories (6 hours each) through the day.

The 18 EV drivers, who participated in this extra demo-project, had their test period extended with 2 extra test-driving months (5 months in total). One of the main reasons behind the extension was that CLEVER wanted to take over the load management half-way (2 ½ month) into the project and thereby check whether the households preferred to load their EVs by

1. The project is supported by Danish Energy and Transport Authority and private foundations.

2. During 2012, CLEVER established more than 60 quick charge stations (ChaDeMo) nationwide in Denmark. At the same time, CLEVER's infrastructure consists of private intelligent charging modules and hundreds of semi-public normal charging points.

3. The test pilots had free and unlimited access to recharging their EVs on so-called quick-charge stations, which are established on the parking lots of the Danish supermarket 'Føtex', in the towns Sønderborg and Haderslev respectively (a quick-charge takes 20–30 min).

4. Today all consumers pay a fixed price on every kWh, which means that consumers do not gain any economic benefit from moving their consumption patterns to other hours during the day.

5. http://www.nordpoolspot.com/Market-data1/Elspot/Area-Prices/ALL1/Hourly/.

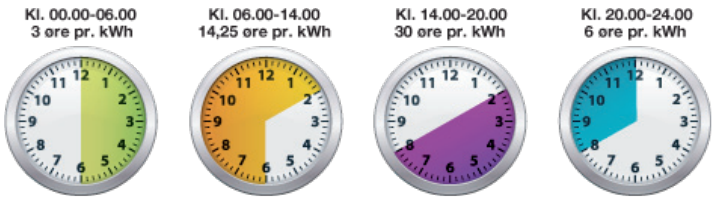

Figure 1. Dynamic Net tariffs for four divisions of the day in hours and prices. The figure illustrates the cheapest consumption hours from 00–06 am and that electricity is 10 times more costly in the peak-time hours from 2–8 pm. 0.04 Euro equals 1 Danish 'øre'. Prices are excl. taxes. SEs permanent net tariff for the spot electricity was 0.2 cent per kWh (February 2012).

themselves or preferred to let the load management be controlled by the mobility operator.

The empirical material

The empirical material was collected through qualitative interviews with 8 participants in the two demo-projects 'Test-an-EV" and "Project Dynamic Pricing". Furthermore, observations were made by participating in CLEVER information meetings and in meetings where the test pilots received and returned their EVs. Moreover, knowledge about the engagement and satisfaction of the test pilots and the success of the demonstration projects was gathered by means of surveys designed by CLEVER. Questions – initiated by this research – about routines, new habits and their persistence has been added in the surveys. Other empirical material consists of information, emails, documents and other 'writings' delivered and produced by the two demo-projects.

Selection of 'test pilots'

In order to extend the complexity and diversity of the empirical material, 8 households among the 18 households or in CLEVER's term 'test pilots' were selected who varied as much as possible regarding socio-economic background variables such as gender, age, education, income, civil state, household size, number of children living at home, daily driving distances, environmental and technological awareness (see Table 1). The assumption behind this is that more diversity contributes to a broader and fuller understanding of the complex nature of users' management and interaction with the technology.

The interview guides were inspired by the semi structured interview approach, characterised by being explorative and open for an in-depth dialogue about practice and everyday behaviour (Kvale 2006, Thagaard 2004). Hence, a trustful relation was sought to be established between the researcher and the test pilot. According to the inherent expectations of the two projects, to the test pilots' behaviour, we were particularly conscious of not representing the projects by clarifying the independence of CLEVER's agenda and thereby attempted to deconstruct expectations outlined in the two demo-projects. The interviewer stressed conversations on everyday life, rhythms, ordinary patterns, routines, conventional habits, temporal consumption patterns, development of new changes and routines – all issues were compared with the households' behaviour before and after obtaining EVs. The interviews were made at different times during the test period, respectively 1 ½ months into the projects and at the end of the test period. The reason for this was based on the idea that after 1 ½ months the households could clearly remember their everyday structure before obtaining the EV, but also on the assumption that routines and habits need time to develop. After the first data collection, it seemed easy for the households to remember their earlier everyday life, which is why we decided to make the last data collection as late as possible in the test period to ensure capturing as many changes as possible. All the interviews were transcribed and selected parts were translated (based on our interpretations) into English and analysed within the theoretical framework (presented later).

Despite the objective to reach complexity in the empirical material, there were several similarities between the 8 test pilots. Even though the reasons for participating were different, all of them were to a certain degree dedicated to testing the new technologies. In this regard, it has been argued that these 8 households were a non-representative group that consists of 'front-runners' or 'first-adaptors' who are particularly conscious, engaged and interested in EV technology (Brady 2010, Jansson 2009, Hippel 1988). Hence, this research argues that a representative case is not always the most appropriate strategy of achieving the greatest possible amount of information. By placing the research within the context being studied, insight in humans' social worlds, experience, behaviour and viewpoints is achieved (Flyvbjerg 2006:236). This case study was typified as 'a critical case' by acknowledging the following "If this is (not) valid for this case, then it applies to all (no) cases" (Flyvbjerg 2006:230). In this regard, it is assumed that if the technology had domestication difficulties among this sample of dedicated people, it seemed even more problematic to integrate it among 'ordinary' households which were less dedicated, engaged and informed.

The analytical approach

PRESENTATION OF SOCIAL PRACTICE THEORY

The Social Practice Theory has developed a series of concepts to capture the dynamic aspects of social practice in order to explain change, stability, novelty, persistence and social order in societies. These concepts are concerned with the understanding of how practices emerge, evolve and disappear in everyday life. Everyday life is where social practices arise, transform and fall and is thereby the ontological objectification of the social practice theory (Shove et al., 2012, Warde 2005, Schatzki 1996).

The philosopher Theodore Schatzki provided the notion of theories of practices[6] with fresh impetus through his recogni-

6. Notions of practice figures in different strands of social scientists e.g. Bourdieu, Giddens, Taylor, Foucault (Shove et al., 2012:6).

Table 1. Selection of test pilots to extend diversity on socio-economic parameters.

Test pilots	Gender	Age	Education	Annual income (in euro)	Civil state	House-holds Size	Children	Transportation need (km)	Environmental awareness	Technological awareness
Test pilot 1	F	61	Skilled*	60,000–101,000	Married	2	0	40–60	High	Medium
Test pilot 2	M	42	Skilled	31,000–60,000	Married	4	2 h*, 1 o*	20–40	Low	High
Test pilot 3	M	51	Unskilled	60,000–101,000	Married	3	1 h, 2 o	60–70	Medium	Medium
Test pilot 4	M	45	Skilled	31,000–60,000	Single	2	1 h	60–70	High	High
Test pilot 5	F	32	Skilled	31,000–60,000	Married	4	2 h	20–40	Medium	Medium
Test pilot 6	F	33	Skilled	31,000–60,000	Married	2	0	20–40	Low	Medium
Test pilot 7	F	48	Academic	101,000–134,000	Single	2	1 h, 3 o	0–20	Medium	Medium
Test pilot 8	M	36	Skilled	101,000–134,000	Married	4	2 h	40–60	High	High

** 'Skilled' stands for 3–4 years' education after finished high school diploma.*

** 'h' indicates the number of children living at home and *'o' indicates children no longer staying at home.*

Some of the categorisations are based directly on information from the applications of test pilots to CLEVER and some were unfolded during the interviews (e.g. 'Education' and 'Children'). The categorisations 'Environmental awareness' and 'Technological awareness' are our own assessments of the 'level' of the awareness of test pilots, respectively regarding energy use and concrete actions to decrease carbon emission and their technological skills. The ratings are therefore subjective definitions.

tion of practices as a routinised type of behaviour formatted by individuality and social order in an on-going process that continually challenge and transform habits and routines in the daily life (Schatzki 1996:13). By the recognition of the social life as situated in practice, Alan Warde considers conventions and standards of practices as steering the behaviour and acknowledge consumption as a "corollary of the way the practice is organised, rather than an outcome of personal choice, whether constrained or bounded" (Warde 2005:137).

What in particular distinguishes social practice theory from other (conventionally) social and cultural theories is the emphasis on involving material configurations in the social practices. Therefore, the social practice approaches have always recognised the role of things and the material dimension in the constitution of everyday life. (Schatzki et al., 2001:3, Warde 2005:137, Shove et al., 2012:9).

CONJUNCTION OF ELEMENTS (HOLDING A PRACTICE TOGETHER)

The social practice approach has developed a concept that captures the dynamic aspects of social practices like e.g. driving, cooking, washing, lighting, bathing, smoking by a means of systematically exploring processes of transformation and stability within social practices and between them (Shove et al., 2012). In this article, we use Gram-Hanssen's interpret of social practices conceptualised into the four elements: 'Know-how and embodied habits' (the way our body takes in things we learn and are socialised to do), 'Institutionalised knowledge and explicit rules' (explicit rules, principles, precepts and instructions), 'Engagements' (motivation and meanings according to doings) and 'Technologies' (technology design makes actions obvious) (Gram-Hanssen 2011b:65, 75). It is through connections between the four elements that stability and change in the social are conceptualised.

Two central notions within the practice-theory approach are the conceptualisation of 'Practice-as-entity' and Practice-as-performance' (Warde 2005:133). Practice-as-performance involves the active integration of the elements that are performed. It is through the active performance and the integration or so-called 'nexus' of elements, that the practice-as-entity is changed and reproduced. Practice-as-entity is the existing practice, conjunction of elements, which can be spoken about as a set of resources. As Warde states "Practices are thus coordinated entities but also require performance for their existence. A performance presupposes a practice" (Warde 2005:134).

The analytical distinction is useful for understanding how changes – novel combination of know-how and embodied habits, institutionalised knowledge and explicit rules, engagements and technologies – are enacted, performed and reproduced by the characteristics of the entity and how the new consumption patterns are sustained and at the same time developed by the practitioners performing the practices (Shove et al., 2012:8). Reproduction and change in practice is developed by practitioners' doings (individuals feature as the carriers of a practice) and their willingness to integrate and link the different elements. In this regard, practices change when new or existing elements are combined in a new way. At the same time, the elements are themselves outcomes of the practices. Warde states that the sources of changed behaviour are developed in the practices themselves, whereby the concept of practices has the capacity to account for both reproduction and innovation (Warde 2005:140). Discussing the implications of using social practice theory in consumer research, Warde assumes that

consumption occurs within and for the sake of practices. Thus, he considers that a competent practitioner requires know-how and commitment in order to deliver an appropriate consumption of goods and services (Warde 2005:145).

Despite change and continuity being regarded as an outcome of the integration of elements, the theory suggests that researchers separate and detach the elements from the practices of which they are a part. At the same time, the analytical approach emphasises the need to be aware of "the trajectories of the elements, and to the making and breaking of links between them" (Shove et al., 2012:22). Moreover the theory states that all practices are internally differentiated so that persons in different situations do the same activity differently (Warde 2005:146). The analytical framework of this article is inscribed in the understanding of seeing social life as constituted by the concrete situational circumstances in local contexts (Clarke 2005).

CONCEPTUALISATION OF THE EV(ERYDAY) LIFE

The conceptualisation of change and continuity in everyday life according to the theory of social practice is consistent with this paper's assumption that sustainable development, transformation and innovation have to become embedded in everyday life. According to the particular focus on smart-grid technologies, the socio-technical approach seems highly valuable in comprehending how social practices and technologies mutually shape each other in specific contexts (Gram-Hanssen 2011b:73, Warde 2005:140). Moreover, the framework underpins Adele Clarks 'Situational Analysis' acknowledging context-specific factors as essential in the constitution of the complexities in practitioners' social practices (Clarke 2005).

This paper focuses on the complex dynamics of social practices according to families living in the South-West of Denmark, who test-drive EVs every day in their everyday commuting. The qualitative approach focuses on the individual households' everyday life and how the 'practitioners' become carriers of particular new practices. Further questions on how routines and embodied habits constitute everyday life will be examined: How does change in one element/new 'material' influence the other elements, meanings and competences? What are the characteristics of the different elements and how are they integrated and linked? How do the new consumption patterns depend on the particular socio-economic conditions in the family? How can change in one practice affect other practices? How do new practices reflect the projects' institutionalised and explicit rules and to what extent will they persist? How do practices and bundles of complex practices relate to other practices – does driving an EV have spill-over effects e.g. do new consumption patterns develop? How are the practices held together in a whole range of practices and as a part of different practices?

Thus, the analytical framework mainly clarifies the trajectories of practice-as-entities by exploring the test pilots' everyday 'sayings', expressions and experience with the new technology. The 'doings' are only explored by proposing concrete questions about concrete habits, temporal actions and activities every day and during weekends. In other words, this article does not include the logged data on 'doings' (collected by CLEVER and SE). Despite the test pilots being convinced that their 'sayings' reflect their real 'doings', their perceptions are not necessary in accordance with 'reality'. A comparison of 'sayings' and 'doings' will be undertaken in later research.

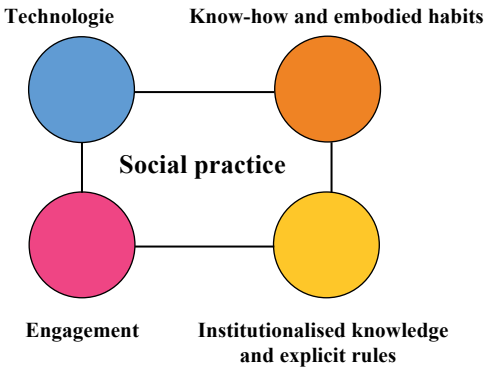

Figure 2. Four different elements holding a (e.g. driving) practice together (and the links between elements).

Analysis of changes and continuity in EV drivers' everyday life

Based on the interviewed families' 'sayings', perceptions and comprehensions of (positive and negative aspects of) the smart-grid technologies effect on their daily patterns, the case study has identified the following two new overall social practices in everyday life: 'New driving performances' and 'new energy consumption patterns'. Based on the empirical material, the analytical sections present the two different, and at the same time integrated, social practices and how they influence the test pilots' everyday life. The conceptualisation of social practices is, more and less explicitly, added to the analysis of the two practices. Some of the elements are strongly integrated and overlap each other, which mean that the content of each element/division is a product of a continuing interpretation process. The analytical sections summarise some reflections on how the 'peak-shaving' technologies, each consisting of the four elements, influence everyday life, their persistence and how the two practices are linked.

NEW DRIVING PERFORMANCE

According to the test pilots' understanding , EV technology influences their 'way of driving' in three overall areas, which can be categorised as: 'more frequent driving', 'consciousness of driving distances' and 'increased awareness of other road users/traffic'. Following considerations on load-management practice and EV-driving as a social performance is examined.

Frequent driving

Almost all test pilots proclaimed that they used the EV more often compared with their conventional car. Some of the frequent interpretations were that the car mechanisms were interesting to try (particularly in order to challenge the battery capacity), that the mechanism/power engine was designed for short and impulsive trips and furthermore that it felt easier and cheaper to make a quick 'get-a-way' in the EV. Consequently, we suggest that the increased EV driving has a tendency to replace cycling and walking and that the test pilots' EV experience created a need for an extra car in the households. The following pronouncement indicated the motivation for an extra trip as a matter of 'testing', 'quick to ride' and 'cost efficient':

> Well, it happens that we take the EV for a little extra evening drive to get it out and test how far it can drive on the last battery power. The miles to the small trips, hang probably a little looser if you own an EV yourself, because it is cheaper to drive and you can easily just take a quick ride (…). As just said, we take an extra driving trip in the evenings e.g. to the beach eating an ice cream and then it is fun to see if we can make it on the last two 'points' [battery indicators]. (Female, 61 years.)

The following quotation exemplified consciousness about the power engine's capability and potential for shorter trips:

> I must say that for these short distances into town, well, then I take the electric car rather than walk as I did before. You don't think as much about saving the car engine, because you don't have the same wear on the electric car, as you have on the other. (…) in a diesel car you better drive some longer distances (…). (Male, 45 years.)

The increased driving means that the test pilots used the car for shopping and visiting and thereby decreased their mobility on bikes and by foot. As a young test driver declared: "We have driven quite a lot of extra trips, where we normally would have biked or walked for example to the shopping mall, then we now take the car every time (…) particular in the weekends." (Female, 33 years.) Additionally, a family father used the EV to do some extra trips every week, as he stated: "So I've taken the car a few extra times to pick up kids at the institutions, where I probably would have walked or biked before. We have surely taken a few more trips – it is like 'arrh, should I just take it?' and then 'Oops, then you are gone with the car quickly eh." (Male, 36 years.) Overall, we suggest that this participant's response was closely related to the test element and the opportunity to use the new technology as much as possible during the test period.

EV driving increases the need for an extra car

All the interviewed households, who already owned one car before the test period, expected that the test driving would increase their need for a second car in the future. This finding seemed paradoxical in view of CLEVER's demand about not to increase car driving in the future. These expectations are not developed by testing the new technology but are rather an outcome of the advantages and e.g. the feeling of 'liberty and individuality/independence' experienced by having an extra car. One of the general and recurrent values was the feeling of 'liberty and individuality/independence' experienced during the test period. As one of the young women claimed, referring to the EV:

> I've suddenly got time just to be me and to do things I immediately want (…) for example I experienced the liberty of not being dependent on waiting for a colleague when I finished work or not to time my life according to the bus schedule (…) it's quite dangerous, because in a short time we have to return it [the EV] and then we need to have a car number two because we have become used to it (…) yeah, in my view it has actually been a little stupid to try, because it worked fine to get a ride with others or take the bus to work, so the car has created a luxury need (…) it is somehow easier to take the car and get your shopping done once in a week. (Female, 33 years.)

Moreover 'comfort and convenience' were benefits experienced by the users. "Suddenly you have two cars and then suddenly you have got a new need for having two cars (…) of course it is more convenient and nice to have two, we have developed a need that we didn't think we had, so to speak." (Male, 36 years.)

In this regard, the development of extra needs and the associated consumption seemed inconsistent with the EVs' expected potential to transform a sustainable energy system. In this context, it is important to quote that the test pilots did not have any expenses (except for electricity costs) related to testing the cars, which means that the need will continue being a desire rather than a realized cost and thus it is questionable that the test-driving actually will develop extra needs.

Huge consciousness of driving distances and consumption

Every test pilot expressed how the EV increase the awareness of driving distances due to the batteries' limited capacity (on average max 100 km per charge). Everyone was very conscious on the electricity consumption while driving and attempted to drive as 'economically' as possible. This led to more consciousness of driving distances and consumption of battery power: "Well I'm certainly more aware of where I actually drive and it has surprised me how much you actually drive. The EVs' battery capacity makes you incredible aware of hey you have again travelled 100 km. (…) well the air-conditioning is only on if it is really necessary." (Female, 61 years.)

The influence of the technology on driving practice was further portrayed in the following notions: "You do notice all the time, the amount of battery left on the dashboard and how many miles you have driven (…) in my view the hugest difference (compared with a conventional car) is that you think about how many miles you drive on one charge." (Male, 42 years.) And further: "The biggest change is the fact that we become more aware of to where and how far I supposed to go. This about calculating distances is something I haven't done before, not to the same extent at least." (Female, 32 years.)

> Furthermore, the limited driving distance of EVs led to a great deal of coordination and planning of conventional driving routines and moreover developed some new skills/competences and techniques. The businessman managed the limited battery capacity by coordinating the different appointments with customers and business partners in a tightly planned schedule instead of spreading them over the week, as he explained "Earlier I just randomly threw meetings in [in the calendar] and now I think 'where do you call from? From Åbenraa! Okay what else do I have to do in that area' (…) during the test period I've become much better to cluster my appointments in specific geographical places." (Male, 36 years.)

New driving techniques

The constant awareness of the limited power engine resulted in the participants developing new driving skills. The most frequent is to turn off electrical devices like radio and air-conditioning and to drive as economically as possible to improve the

range of driving. A test pilot, who drove at least 70 km every day, supplied a detailed description of economic driving. The following is a selected excerpt from a long description:

> You drive economically by avoiding to decelerate [laughing] (…) it's really about not to press too hard on the accelerator and then keep a constant speed. By the way I really miss a cruise control in the car. On the road between Åbenraa and Sønderborg there are five roundabouts and then I have learned to slow down the car, so I can release the accelerator and thereby recharge the battery it shows how economically you are driving [referring to the dashboard]) it goes down and write charge (…) you could actually take the roundabout with 40/50 km/h and then you do not use so much power for acceleration. So it is actually possible to drive back and forth to Sønderborg without full stops. (Male, 45 years.)

The new driving techniques contain an element of competition about to beat 'your own driving record and to challenge your partner's and further to more conversation with your partner about 'driving distance, battery capacity' etc. As one test pilot said "The funniest part is the competition between me and my partner to see who can drive the longest on a loaded battery." (Female, 33 years.) Apparently, this 'competition and playing' aspect was linked to the test phenomenon and reflected somehow a kind of new element. The persistence of these activities would probably decrease during the test period. The following illustrates the test sensation and is probably an example of an activity that only happens once: "One day I tested how many miles I could get the engine to drive and we almost manage to drive the maximum 140 km., no extra electricity use was on and then we just cruised around until the battery alerted us." (Female, 32 years.)

Increased awareness of other road users (and spill-overs to conventional driving)

Due to the material components of EVs, the majority of the test pilots had become more alert to the world outside the car. One of the typical consequences of a noiseless and vibration-free engine is the risk of faster speed during driving, which led drivers to be more aware of the speedometer and the surroundings in general. The noiseless technology was portrayed as having negative and positive aspects. The negative aspects typically concerned the uncertainties related to pedestrians and bikers, who also orient themselves by sounds, as clarified in the following: "People don't hear and see you, so you can't for example just back out. Pedestrians don't have a chance, because it doesn't say anything, which means that you can sit there in a long time just waiting to come out. Bikers can't hear you and in general it feels insecure." (Female, 61 years.) Another test pilot explains: "You can't just toot when you park, then you will shock people (…) But in general you learn quickly to pay extra attention." (Female, 32 years.)

Besides the uncertainty linked to the silence, the sensitivity of the EVs to external forces was further emphasised as something that increased 'the feeling of insecurity'. "The other day when it rained and it was really windy and cold, I switched on the fan and turned a little bit up for the heat and then the power meter immediately began spinning (…) so do not travel 50 km from home in hard weather conditions, because then you will not arrive before sunshine and you've got the wind in the back." (Female, 61 years.) This problem will apparently intensify in the winter period.

At the same time, quite a few test pilots favoured the silence and associated the peace in the car with something 'relaxing' and 'mindful' and appreciated that they did not have to shout to each other to drown out the sound of the radio, which conventionally is turned on to minimise the noise from the car engine. Especially a mother to two small children 'embraced the soundlessness', as she said: "The soundlessness makes it simply totally relaxing to drive home. The head gets straight and it's incredible how it allows your brain to calm down. Then I must admit, when you have picked-up the two children and get them into the car, you suddenly get a noise level that kicks ass. But oh yes, those 10 minutes in the car in total peace, no talking, no yelling, no nothing. It is simply a relief." (Female, 32 years.) Quite a few test pilots found that the increased awareness of their driving and new techniques would spill over on their conventional driving, which was considered to be a positive consequence of the test period, as a test pilot declared: "It [new skills] will be transferred to my other car. You were aware of those savings tips in advance, but you didn't practice them for real. Instead you just refuel gasoline on and drive. You can drive much more economically and a lot of people could save huge amounts of gasoline by driving a little differently." (Male, 45 years.)

Load management

After 2 ½ months, CLEVER took over the individual load management and controlled the recharge process according to the lowest electricity price on the market. This transformation from private to central load management was received as a positive fact among all test pilots, especially motivated by the economic gain and convenience. In this regard, it seems important to mention that most of the test pilots (five) expressed having problems installing the timers and a few (two) had decided not to use the timer at all. The households that could not get the timer to work had informed CLEVER and as a result another couple had had a new load-box installed that worked correctly.

Hence, it seems difficult to judge whether the technology was incomplete or whether the test pilots did not have the competences to manage the load-box or simply not prioritised how to learn how to use it. Nevertheless, the consequence was that almost all test pilots plugged in the load-cable manually until the net tariff was low after 8 pm. The fact that the technology did not work or perhaps was too complicated hindered us in concluding that the interviewed households preferred to be as passive as possible by handing over the load management to the mobility operator. Exactly this issue – a comparison of individual versus centrally controlled load management – was paradoxically one of CLEVERs main objectives of this particular case.

Regarding to the problems related to the concrete technology, the test pilots were overall content with the introduction of load boxes in their homes. Even a few test pilots actually found the principle/concept about home load management to be convenient and expressed relief at not having to go to petrol stations: "It is convenient that you avoid running away to the petrol station and instead managing to charge by yourself. In my opinion it always has been a plague to refuel, it takes time

to refuel especially when the gas station is not on the road." (Male, 43 years.) Besides the bug problem, all test pilots found that their individual option of charging their EV to be a great relief and considered that the plug-in practice to have a minor impact on the everyday life.

The reason why the load management had insignificantly influenced their everyday rhythms was presumably that the test pilots quickly got the technology integrated according to other routines. Typically, they linked the plugging-in practice to their habits connected with turning off lights in relation to their sleeping practice. In the following a test pilot points out how load management had become a routine in daily life: "It is a kind of reflex like locking the house before the night to plug in the cable in the car." (Male, 45 years.)

The test pilots in general expressed that the load management in itself had already become a kind of everyday routine. In spite of that, some test pilots considered the load practice as one of the biggest changes and 'something extra to remember'. These statements occurred in relation to EVs' extended level of planning and coordination, which was caused by both the limited operating range and the new load-management practice. The most obvious objections came from a 'partly single' mother (due to her husband's job as a sailor, she was alone with their two small children every second month): "Every day I consider whether it is necessary to load or whether I can wait until tomorrow (…) I am constantly aware of where to go during the week (…) this is a disincentive in daily life." (Female, 32 years.)

Furthermore, quite a few test pilots confirmed that the recharge infrastructure was too incomplete. One of the test pilots declared the time aspect to be one of the crucial turning points and did not consider the price element to be something essential to adopt: "The quick-chargers are way too slow (…). I am privileged that I have all the money that I need, so it is the time which is costly for me and I am not willing to spend time on that." (Female, 48 years.) For her, the load management decreased her 'flexibility and liberty', which for her seemed to be the most important values. This emphasised that the test pilots generally had an uncomplicated relation to load management. An explanation could be the test pilots' commitment and loyalty to the test project and its expected obligations to the participants.

Breaking conventions and norms

Although it seemed that the load management overall had a minor impact on the everyday life of households, all test pilots expressed concerns about the 'unstable' load box and the few times when the charge process had failed. Some test pilots expressed how these few stressful moments or breaks in their everyday morning routines led to a more permanent feeling of insecurity. In general, families with children have a tightly coordinated everyday life, which meant that the load management increased the level of planning:

> Well, it means I have to do things different than I'm used to and plan more. For instance the mornings are become much more uncertain because I have tried to experience that the car hasn't charged (…) It means that I sweat a little more. Such unexpected situations make me totally crazy, I fear the worst and the worst that can happen is for instance to run out of power (…) my day has such a tight time schedule, so three hours waiting for assistance simply destroy the rest of my day and tied planning. (Female, 32 years.)

One test pilot accidently experienced to run out of power on a longer driving distance. For her, this experience was completely unacceptable and limited her feeling of flexibility of lifestyle too much, as she proclaimed: "It is unacceptable that I should have to stop and charge on the way, I mean I've got this feeling of 'it is not okay, it is completely unacceptable, I simply do not permit that'." (Female, 48 years.) Presumably this dry-driving risk is related to EVs test-technology status.

Mainstream technology as a success criterion

The notions of the test pilots about positive and negative aspects of EVs were constantly compared with the mainstream conventional car technology. The positive elements reflected EV similarities to conventional cars (design and acceleration) and the negative objections surrounding EVs were the 'driving distance per recharge' and limited 'production costs', which were also the main critical issues addressed in the literature/state-of-the-art of EV adoption. (Sovacool and Hirsh 2008). In spite of this, all test pilots stated that EVs were a good city car and as such compatible with their daily needs. Its limited range challenged the adoption, which was typically connected with drivers' expectation of 'cars' symbolise values as freedom, independence, a necessity and the flexibility to visit family and friends spontaneously without planning etc. Accordingly, a frequent statement was that the limited driving range of the EVs required a conventional car for longer trips. With regard to the constant comparison, it seemed straightforward to proclaim EV users to be conservative consumers[7] by their constant comparison of the EVs with conventional cars, which was represented among producers (car manufacturers) expectations to absorb EVs by the mainstream technology. Although, the test pilots range design, commitment, advertising, costs differently etc. particularly uncertain factors like costs related to servicing and maintenance of the new technology seemed to dominate the test pilots concerns. Remarkably, no test pilots mentioned the economic fortunes related to EVs. Compared with conventional cars, the EVs are more than half as cheap in daily costs due to the much lower electricity price compared with fossil fuel prices.

A strong social performance of sustainable consumption behaviour

Environmental and green aspects were weighted highly and played a significant role for the test pilots' engagement. Consistent interpretations according to their participation as test pilots were 'a feeling of well-being and cleaner conscience', 'societal responsibility and contributing to curbing emissions' and 'positive feed-back from surroundings'. Therefore, it was a central question how consumers thought of themselves as sustainable consumers.

A feeling of doing something good for the environment and a feeling of less guilt characterise self-perceptions of the test pilots, as illustrated by the following expressions:

7. Sovacool and Hirsh argue that consumers instead of embracing new technologies seek tradition and familiarity when they make consumer choices, especially when they deal with hardware that requires high capital investment (Sovacool and Hirsh 2008).

> You do something it's like walking around with a Greenpeace batch on. There is a strong signal value in driving around in an electric car (…) I think it's nice to drive around without polluting, because some of the electricity comes from wind sources. And it gives me a really good feeling. And well, I'm sure the world would be much better if everyone drove around in an electric car. And I am also sure that in 20 years people drive around in electric cars. It is 100 % for sure. (Male, 45 years.)

Societal responsibility by contributing to curbing emissions seems a further motivating factor for participating:

> (…) the positive thing is of course that we do something extra for our society (…) we are all somehow responsible for taking care of the world for our children and children's children sake. (Female, 61 years.)

One test pilot even declared: "I am not so guilty about driving an extra tour because I do not think that I am doing anything wrong to the world." (Female, 33 years). A further view comes from a test pilot, who identified himself as 'environmental defender', who produced all his energy by PVs, which in his opinion made it even more meaningful to have an EV: "(…) and then the sun has recharged my car, then I can drive on my own system (…) I haven't burdened anything and this is a very nice feeling." (Male, 36 years.)

To a lesser or greater extent, all the test pilots were aware of their social performance as sustainable consumers. Some were explicit about their engagement in their considerations of EVs as a prestigious technology due to its strong environmental signal values. Consequently, the test pilots talked and socialised more when they went out shopping and visiting, for instance many of the EV drivers experienced positive feed-back from colleagues, family, curious strangers and other test pilots. All test pilots were proud of their EVs and regarded the increased socialisation (and to some extent promotion of the EV) as a completely positive thing. As one test pilot explained: "It has been an extra boost in everyday life to run in the electric car… to offer people a ride and a chit-chat. It has been a cool experience." (Male, 42 years.)

Promotion, answering questions and in particular to break people's expectation were highlighted as positive and motivating elements. As the enthusiastic businessman stressed: "You get a lot of contact with people when you drive around in this one (…) it is really nice, there are many who comes over and ask about it, and then you do a little advertising and talk positive about it." (…) I think the environmental appearance has been really good, both according to my personal but also to my company's image." (Male, 36 years.) Here, the EV-driving is an excellent way to brand his company's green profile.

EV driving conceptualised through the four elements

Even though EV technology shares similarities in many areas (particular design, comfort and acceleration) with conventional technology, the battery makes the engine more sensitive to external forces, limits the driving distance and demands load management. The test pilots' expressions about the EVs potential and barriers were constantly compared with the standards of conventional cars. Based on general understanding of EVs as easy to drive, quick, convenient, maintenance-free and an excellent city car, it seems that 'know-how and embodied knowledge' related to EV driving is broadly comparable with the 'know-how' related to conventional driving.

However, this picture becomes more complex by recognising a new 'way of driving' caused by the limited range and the sensitive, noise-less engine of the EVs. The new 'way of driving' is characterised by developing more economic/sustainable driving techniques and increased awareness of consumption during driving. Further, the test pilots developed a more careful style of driving, more frequent driving and the need of a second car. In other words, the material agency develops new know-how and embodied knowledge that transformed the driving style and made transportation needs and habits more visible. Furthermore, it was acknowledged how both improved awareness on energy consumption during driving and increased consciousness of external conditions could spill over on conventional car driving.

In general, the test pilots found activities connected with the load box and load management simple and uncomplicated. Nevertheless, several test pilots expressed frustrations problems connected to install the timer in the load boxes which required manual load management. Presumably, this factor explained the test pilots' satisfaction with letting CLEVER control/peak-shave the charging process. In this regard, we emphasise that the element of 'institutionalised knowledge and explicit rules' (learning, information and demands) delivered by CLEVER had a crucial impact on the driving and especially the load management during the night. Further, the element of engagement seemed to be crucial for the 'way of driving', especially according to the 'test pilots' self-perception as sustainable consumers. The test pilots perceived their participation as meaningful by contributing to curbing emissions and a 'greener' behaviour. All test pilots considered EVs to be prestigious and were proud to be driving around showing their new technology (and 'responsibility') to their surroundings. In this way, the test pilots insinuated that they got positive feed-back from their surroundings and that EV driving in general led to a good feeling of well-being and a clear conscience.

TIMING: NEW TEMPORAL CONSUMPTION PATTERNS

Project Dynamic Pricing had apparently moved the test pilots' everyday electricity consumption patterns. Every household attempted to move their 'flexible' electricity consumption to the night when the net tariffs and spot-electricity price were lowest. The 'flexibility' electricity consumption included dishwashing, laundering and drying, and obviously the charging of the EV. Thus, all test pilots loaded their EVs during the night and used timer mechanisms to postpone their laundry until nights when tariffs were lowest. The move of flexible consumption by all test pilots indicated that Project Dynamic Pricing's overall aim (at least in the experimental phase) was achieved.

In the following, we dispute that the engagement to move electricity consumption was driven by respectively 'an economic' and 'an institutional' incentive. Next, we emphasise that these new consumption patterns influence other practices and how the flexibility depends on contextual socio-economic conditions. Furthermore, the tendency to increased environmental consciousness is acknowledged. The different elements of the practice are then conceptualised.

Economic, environmental and institutional incentives

Every test pilot considered the electricity price and the 'money-saving factor' to be essential in order to increase the incentive to change consumption patterns. Presumably, the extra electricity consumption caused by the EV improved the economic incentive[8] to move the consumption patterns, as one test pilot declared: "If we didn't have a car (EV), the benefits of the Project Dynamic Pricing would have been incredibly low." (Male, 36 years.)

In general, the expectations to the up-coming electricity invoice were huge, though many of the test pilots realised that the amount of money actually saved was 'peanuts'[9] and emphasised that a permanent change demanded a bigger economic gain. More test pilots expressed that a graphic visualisation and some concrete calculations on the actual savings would increase their incentive. While every test pilot knew the four dynamic tariffs by heart, hardly any checked out the 'spot electricity' (changing every hour) claiming this activity as 'too time consuming and unnecessary'. Generally, concrete and simple communication about savings and prices appeared to be vital in the busy everyday life, as stated: "Well, it is a must that the price only changes four times a day." (Female, 32 years.)

The project rules, conceptualisation and requests to the test pilots influenced the test pilots' expectations and their level of participation and commitment. The test pilots had agreed to several requirements (signed a contract) out-lined by CLEVER in order to participate and every participant was aware of accommodating the expectations from both demo-projects. On the information meetings the project managers were encouraged by the following phrases: "the first projects ever integrating EVs and Dynamic Pricing", "that the future demands new consumption patterns", "EVs become first a realistic alternative when consumption patterns change", "test pilots are capable to save money and contribute to sustainability by moving their consumption" and that the overall project aim was to "test the test pilots flexibility".[10]

From this aspect, more than a few test pilots emphasised their motivations by preparing some good habits in order to meet the future energy scenario, as one test pilot mentioned: "I have been conscious about moving my energy consumption for a long time, because I know it will be the future. It is the future." (Female, 32 years.) Environmental aspects were not apparent as a separate issue according to changed consumption patterns.

Throughout the qualitative interviews, the test pilots referred frequently to the expectations from the demo-projects. In this regard, it seems relevant to highlight the probability that the test pilots' new consumption patterns were changed by their own expectations that to some extent at the same time were constructed by out-lined requirements (and discourses around and within) the two demo-projects. One test pilot was obviously not driven by economic incentives, but rather the forecasting expectations given by Project Dynamic Pricing: "I do not care about the prices, but the project declared through the low prices the great need to move consumption to the night and I thought I better do it too." (Female, 48 years.) From her point of view, also her and her daughters' low energy consumption meant that the actual savings were too small. The explicit and implicit expectations roughed out by CLEVER were asserted by another test pilot excusing his limited commitment by referring to his duties at the job: "I really wished to deliver but the high expectations (from CLEVER) I wasn't able to meet. I haven't applied what I supposed. They provided us with a car, I signed up and agreed to do different things and it is such a shame that I didn't fulfil all." (Male, 36 years.)

In addition, all test pilots find some of the conducts/duties related to participation disturbing and time-demanding. The worst element is the so-called driver's log book (the test pilots registered information about every single drive in the EV), but also the daily blogging on the 'test-an-EVs' homepage was considered to be a difficult, time-consuming obligation. Inconsistent with the project aim to commit participants through incorporation/implementation of several obligations etc. the test pilots actually considered those out-lined institutional expectations (and rules) as too (time-) consuming but not unreasonable.

Constitution of new routines

The new consumption patterns constitute the households' morning routines. A direct consequence of laundering and dishwashing during the night were the developing of some new routines concerning 'hanging up washing clothes' and 'emptying the dishwashers' in the mornings. The impacts of the new practices/domestication processes proceeded differently according to the social-economic conditions of families and had different implications for flexibility. For instance, the interviewed families' with 1–3 children and pets seem not as flexible as households consisting of singles or couples with no children or pets.

In the following, test pilots with families with 1–3 children are presented, who considered the 'new element to remember' to be a disturbing extra element that interrupted the morning routines and habits and was the overall cause that the already tightly scheduled mornings became more pressured and stressed, as a family father highlighted according to their new consumption patterns "to remember that and further to remember that and that, today one is hanging up the washing clothes while the other empty the dishwasher. We need to rub our nails a little more, we have to hurry up more, to take shorter showers and let our child find her clothes faster." (Male, 42 years.)

It seems like, singles and the older couples were often more flexible in their habits and electricity consumption and e.g. more willing to compromise on their comfort than families with (small) children or pets. But the picture was more complex; for instance the older couple explained that they were less willing to move consumption when their children and grand-

8. In comparison, SE's Project Dynamic Pricing testing flexibility on over 200 households without EVs shows hardly any change of consumption patterns, which SE interprets as evidence that the economic incentive is way too low.

9. One of the main challenges for making consumers more active is that today households' electricity consumption is paid according to the average expenses and includes considerable taxes and tariffs. Despite the liberalisation of the Danish Energy Market (in 2003), the competition effects are limited, because the high taxes and tariffs limit the economic savings (Konkurrence og Forbrugerstyrelsen 2011). Pressure from the market liberalisation and smart grid challenges these conditions, which are expected to change with the so-called 'wholesale' model to be implemented in 2014.

10. The expectations were announced on two information meetings with the test pilots initiated by SE and CLEVER.

children were visiting. Furthermore, the degree of flexibility was related to the kind of job, the range of income and family size.

Increased awareness of electricity consumption and environmental consciousness

Almost all test pilots suggested that their environmental consciousness had been increased by their participation in the two projects. The interviews and the surveys indicated that test pilots saw themselves and their family as a whole and as more sustainable consumers in the future. Though all 8 test pilots were aware of energy consumption before they participated, they expected their consciousness to increase further, which was clearly stated in the following expression: "I am sure that this last half year led to a lower energy use and that it has influenced our reflections of what we actual do and when. I am convinced that the EV is crucial for increasing the awareness of energy use." (Female, 61 years.) Furthermore, Project Dynamic Prices increased the test pilots' awareness of the crucial role of the consumers and their responsibility in relation to changing their daily consumption patterns.

In this case, the participation had spin-offs on other areas in everyday life. Some expressed that they were more aware of turning down unnecessary light, to pack the dishwasher more, to check the weather before washing in order to sun and air dry laundry, wait to start the dishwasher until it was full etc. As an older couple highlighted about the two projects "the greatest change is that no doubt we have become more consciousness of electricity use and consumption." (Female, 61 years.) Again, it is impossible to predict the persistence and anchor of this apparently greater energy consciousness.

The four elements' constitution of new temporal consumption patterns

All test pilots moved their flexible electricity consumption to the night time, which meant that laundering and dishwashing activities occurred on other hours during the day. The empirical examples of households' postponement of electricity consumption indicated that Project Dynamic Pricing mattered. In the above analysis, we demonstrated how engagement to a high degree appears to be due to the element of 'institutionalised knowledge and rules' that constructs respectively 'economical' and 'institutional' incentives to move consumption.

This article further demonstrates how new consumption patterns interrupted households' morning routines which further developed some new routines about 'hanging up laundry and 'emptying dishwashers' in the mornings. Moreover, the impacts of the domestication processes proceeded differently according to family structures. Socio-economic conditions like family-size, income, age etc. influenced on the individual degree of flexibility and incentive to move electricity consumption. Especially families with children had a tightly coordinated everyday life, which meant that they had less potential flexibility, which meant that the Dynamic Pricings was considered to be an extra interrupting element that increased planning and coordination and made an already stressful everyday life more uncertain. Although routines and habits challenged flexibility, it seems remarkable that the entire group of test pilots participating in the two projects (18 test pilots) moved all their flexible energy consumption to hours with low demand, especially in regard to the very low amount of money saved.

Conclusion

This article has presented how two peak-shaving technologies changed consumption practices by influencing the delimited driving practice and developing new consumption patterns in the everyday life of households. Through the households' 'sayings' about their performances, it was possible to clarify the significant elements in the two new practices-as-entities, i.e. the new driving performance and the new temporal consumptions patterns. This article demonstrates how changes in consumption practices started in the everyday life of households through innovation in the different elements. Change in for instance 'technology', 'engagement', 'institutionalised knowledge and explicit rules' and 'know-how and embodied habits' changed routines in the everyday life and create new normalities by new combination of elements in the practices. This research showed how changes in the elements 'technology' (EV) and 'institutional rules' (new electricity pricings) influence the 'engagement element' by increasing people's consciousness about their energy consumption which in turn influences individual electricity consumption.

Furthermore, the research found how social consumption practices were linked and how change in one practice influenced another. The new 'driving' and 'timing' were closely linked mainly by sharing the elements of 'engagement' and 'institutionalised knowledge and explicit rules', which influenced the test pilots' 'doings' by the test projects' experimental character. We emphasise that the experimental test element was essential for the test pilots' peak-shaving activities and their level of participation and commitment. In other words, the persistence of the new consumption patterns and the practitioners willing to keep them alive seem doubtful. It is assumed that the new consumption patterns will 'fizzle out' after the test period ended. Like in many other demo-projects, the commitment of the test pilots will presumably decrease in the long run. The experimental short-term integration of Dynamic Pricing and EVs explained the 'acceptance' of inconvenient elements (limited driving distance, decreased flexibility and the uncertain stressful elements). In this regard, we stress that the limited test period to some extent prevented the new habits and routines from being really embodied. Time-and-space-significant impact on (anchoring) social practices was crucial for the recognition of this approach to the context-specific situational factors as geography/place, socio-economic elements and the limited time-schedule of the demonstration projects. A significant insight was obtained into the complexity of flexibility according to context-specific factors. The technologies and non-human elements impact on conventions and norms (and breakings) differed according to the specific character of normality in the test families. The socio-economic conditions were significant to the kind of incentive and degree of inconvenience in order to integrate the technologies in the everyday life.

Moreover this paper recognises how (consumption) practices are highly integrated with other practices. The two new practices are for instance linked through the increased economic incentive to recharge EVs when the electricity price is low. Moreover, the investigation clarifies how the new load management is integrated into conventional everyday rhythms like for example the sleeping practice and the daily shopping. Moreover, we stress the close integration of elements by for in-

stance the close link between the expectations and engagement of institutionalised rules. This article emphasises how participation changed the attitude and comprehension of energy use and consumption in other areas of everyday life. Hopefully, the increased consciousness of new habits and routines will affect everyday life in the long term.

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