



# Customer value of smart metering: Explorative evidence from a choice-based conjoint study in Switzerland

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## HIGHLIGHTS

- ▶ We model the importance of customer value of smart metering.
- ▶ We shape the model on a choice-based conjoint experiment.
- ▶ Overall customers perceive a positive value from smart metering.
- ▶ Customers are willing to pay for smart metering.
- ▶ There are four distinct customer segments with different value perceptions.

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## ABSTRACT

Implementing smart metering is an important field for energy policy to successfully meet energy efficiency targets. From an integrated social acceptance and customer-perceived value theory perspective we model the importance of customer value of smart metering in this regard. We further shape the model on a choice-based conjoint experiment with Swiss private electricity customers. The study finds that overall customers perceive a positive value from smart metering and are willing to pay for it. Further, based on a cluster analysis of customers' value perceptions, we identify four customer segments, each with a distinct value perception profile for smart metering. We find that energy policy and management should integrate a solid understanding of customer value for smart metering in their initiatives and consider different smart metering market segments within their measures.

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## 1. Introduction

In a new proposal for an energy efficiency directive from June 2011, the EU renews the goal of reducing energy consumption by 20% by 2020 (COM/2011/0370, 2011). This has already been a key element of the Directive 2006/32/EC (Directive 2006/32/EC, 2006). In 2011 the EU points again to the importance of rolling-out smart meters but also states that failing to help end-users to save energy might be a major obstacle to mass-market diffusion (European Commission, 2011). This points to the importance of considering a customer value perspective when implementing smart metering. The importance of a customer value perspective is also evident in a statement of the European Smart Metering Alliances, which names customer acceptance as one of the main issues for smart metering: “Energy savings from smart metering and information feedback

depends on acceptance and understanding by consumers of the basic premise. (...) Consumers should receive appropriate benefits from any cost reductions achieved by the Energy supply industry resulting from smart metering although this should not negate the financial drivers for the utilities” (ESMA, 2012). Despite being crucial for smart metering, research mostly focuses on engineering aspects of smart metering, and only a few studies point to customer needs (Forsa, 2010; Kranz et al., 2010; Giordano and Fulli, 2012). Furthermore, research from a customer perspective focuses mainly on the potential of reducing energy (and related costs) and on the effect of different energy tariffs (Faruqui et al., 2009; Stromback et al., 2011). However, smart metering offers all kinds of different services to customers and utilities alike. For example, a connected advanced metering infrastructure (AMI) allows for remote meter reading, accurate monthly billing, and enables demand response and load management (Leeds, 2009; Ryberg, 2010; Appelrath et al., 2012). Furthermore, if the smart meter is connected to the home area network, consumers can be provided with energy consumption feedback systems, with remote programming and steering services for appliances, with security services as well as with the possibility to manage decentralized

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energy feed-in from e.g., renewables or intelligent charging of plug-in electrical vehicles. For an overview about existing smart metering and smart grid technologies, providers of those technologies and resulting smart metering services we refer to the relevant literature (European Commission, 2005, 2006; ESMA, 2008; SFOE, 2009, 2012; Leeds, 2009; Forsa, 2010; Ryberg, 2010; Appelrath et al., 2012).

Although a mandatory rollout of smart metering would foster the nationwide implementation of smart metering, it is unlikely to play a significant part in achieving a 20% reduction in energy consumption when it fails to incorporate the issue of consumer acceptance. First, an undifferentiated mandatory smart meter rollout might lead energy providers to either choose the cheapest smart metering solution or to implement smart metering services that provide value to the energy providers but not to the customer. Other services, which could provide value to the customer but are not perceived as highly profitable to the industry, might thus be disregarded (Marvin et al., 1999; Neenan and Hemphill, 2008; Darby, 2010). This could lead to suboptimal results because the lack of customer value prevents consumer acceptance of smart metering technologies. Customer value and consumer acceptance are crucial because only when customers perceive a value, they become interested in the technology and start using it (Davis, 1989; Kim et al., 2007) in their daily life, which – in the case of smart metering – might ultimately result in a reduction of energy consumption (Marvin et al., 1999; Neenan and Hemphill, 2008; Honebein et al., 2009; Darby, 2010; Clastres, 2011; Giordano and Fulli, 2012). Second, even if policy makers oblige the industry to include certain services of value to customers into a mandatory smart metering solution, the results might still remain suboptimal with regard to the goal of reducing energy consumption by 20%. It is likely that consumers' value perceptions of smart metering services – like for many other services – differ among various customer segments (DeSarbo et al., 2001; Ruiz et al., 2007; Wiedmann et al., 2009). Thus, even if this mandatory smart metering solution attracts some customers, it might fail to attract others (Darby, 2010). By ignoring the heterogeneous customer needs in the market, broad consumer acceptance of smart metering might not be achieved. Therefore, effective energy policy requires a sound understanding of different value perceptions of smart metering to design effective measures for smart meter implementation.

The study at hand intends to reveal the preferences of Swiss private energy consumers for smart metering services. The work is guided by the question, what is the perceived value of smart metering services for customers.

From an integrated social acceptance and customer value perspective we first model the importance of customer value of smart metering. We then test the model on a choice-based conjoint experiment with Swiss private electricity customers. The study finds that overall customers value smart metering and are willing to pay for it. Further, based on a cluster analysis of customer preferences, four segments were identified, each of which with distinct value perceptions of smart metering. We find that energy policy and management should integrate a solid understanding of customer-perceived value for smart metering in their initiatives and consider the different market segments within their measures.

## 2. The role of customer value and of value-based segmentation for implementing smart metering

Our basic model (Fig. 1) states that customer value is crucial for implementing smart metering. The model is derived from an integrated social acceptance and customer value perspective. The basic premise is that – as for all innovative energy technologies

– social acceptance among various stakeholders is a precondition for the successful implementation and diffusion of smart meter technology and related services (Wüstenhagen et al., 2007; Wolsink, 2012). Among the most important stakeholders are customers (those who buy and/or use smart metering) and firms (those who develop and/or provide smart metering). A successful diffusion would require balancing the interest of those stakeholders in a pareto-efficient manner, so that all stakeholders maximize their value.

Whereas the company perspective is less critical, as firms usually are good in realizing their model, the customer value perspective is more crucial and has been approached by different research (Zeithaml, 1988; Sheth et al., 1991; Parasuraman, 1997; Slater, 1997; Woodruff, 1997; Holbrook, 1999; Belz and Bieger, 2006). According to Zeithaml (1988) and Sheth et al. (1991) consumers purchase a product or service if they perceive some kind of positive value. Zeithaml (1988) defines perceived value of a product or service as an overall assessment by the customer of what is given (drawbacks) and what is received (benefits). It is important to note that according to this definition value is not objective or simply given, but rather it is based on an individual perception. Regarding smart metering this means that the customer-perceived benefits of smart metering must exceed the perceived drawbacks. Only then will the customer accept, be willing to pay for and use smart metering services. Meaning, only then will there be a market acceptance of smart metering by consumers, which is a part of social acceptance (Wüstenhagen et al., 2007; Wolsink, 2012). In order to ensure market acceptance of smart metering by firms – another part of overall social acceptance (Wüstenhagen et al., 2007; Wolsink, 2012) – firms must receive some kind of revenue in exchange for developing and providing smart metering services, e.g., via the price the customers pay for these services. From the company perspective the price is important to notify and satisfy the firm's value on smart metering. From the customer perspective, however, the price consists of a drawback and thus reduces the overall customer-perceived value (Zeithaml, 1988). The spotted arrow with the dollar sign in Fig. 1 demonstrates this relationship. When deciding on which smart metering services to offer and how to price them, two things are of critical importance. First, one should have a thorough understanding of which smart metering services provide benefits to the customers. Only those services would be able to compensate for the perceived drawback of the prices because they offer enough benefit in exchange and thus elicit a willingness-to-pay (Zeithaml, 1988). Second, price setting for a service should be based on an assessment of customers' willingness-to-pay instead of a cost plus approach to ensure that the overall customer-perceived value (now also including the price) of the respective service is positive and thus leads to customer acceptance and purchase.

Following the concept of customer value and social acceptance, the customer-perceived benefits of smart metering should exceed the perceived drawbacks in order to ensure market acceptance and diffusion of smart metering. Previous research claims that customer-perceived benefits indeed exceed the perceived drawbacks (Forsa, 2010; Curtius et al., 2012). Thus, we assume:

**Assumption 1a.** Customers are willing to pay for smart metering.

**Assumption 1b.** The positive customer-perceived value of smart metering will in turn result in purchase and in market acceptance of smart metering by consumers—a part of social acceptance.

Furthermore, as smart metering can provide a variety of services, which offer different benefits, one can assume that

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