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# Willingness to participate in direct load control: The role of consumer distrust

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## HIGHLIGHTS

- Consumers use trust and distrust as decision heuristics to help guide behaviour.
- Distrust may reduce willingness to participate in direct load control programs.
- Efforts by a utility to regain customer trust may increase willingness to participate.
- Using mixed methods, we conduct a survey-experiment to examine these issues.

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## ABSTRACT

Addressing the challenge of peak demand is a major priority for energy utilities, regulators and policy-makers worldwide. Against this backdrop, residential demand management solutions – including direct load control technology that allows utilities to turn specific household appliances on and off during peak periods – are becoming increasingly important. While such technology has been available for decades, acceptance and adoption among residential consumers has not always kept pace. Why is this so? Drawing on key principles from psychology and behavioural economics, we propose that consumer distrust can play a significant role in the uptake of demand management solutions. As part of a large field study, a survey-experiment was conducted to investigate householders' willingness to participate in a direct load control program offered by an Australian energy company. To specifically examine the relationship between self-reported distrust and willingness to participate, and how this relationship might be influenced, the survey included an unobtrusive experimental manipulation: a simple two-sentence message designed to rebuild consumer trust and confidence in the utility was conveyed to a randomly-selected subsample of participants. Results suggested that participants' self-professed distrust in the utility was associated with significantly lower willingness to register for the DLC program. This unwillingness was modestly reduced for those participants who received the trust-restoring message upfront. Together, these results suggest that distrust may serve as an important decision-making heuristic used by consumers when choosing whether to accept new demand management technology and services. Implications for future research and practice are discussed.



## 1. Introduction

Peak demand – the daily and/or seasonal spikes in consumer demand for electricity – plays an important role in the costs of electricity generation and supply. Demand-side management (DSM) solutions to curb peak demand have therefore gained significant attention among industry stakeholders worldwide, as they offer an effective means of reducing future investment in costly network infrastructure that is specifically built to meet maximum demand levels. DSM is an overarching term that describes an increasingly diversified range of activities, but can be broadly defined as "a utility action that reduces or curtails end-use equipment or processes [and] is often used in order to reduce consumer load during peak demand and/or in times of supply constraint" [1]. It includes everything that targets the demand side of an energy system [2], ranging from brief curtailment of energy usage via load

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management systems through to more ongoing or permanent improvements in efficiency via new energy-saving technology.[3] DSM activities can be classified into several categories [for a conceptual review and taxonomy, see 2], but are broadly understood to include both energy efficiency (e.g., permanently reducing demand via more efficient appliances) and demand response (e.g., reactive or preventative measures to reduce, stabilise or shift demand, including incentive-based programs like load control and price-based measures like dynamic tariffs) [5–7].[4]

### 1.1. Value and untapped potential of residential DSM

Although the total level of load reduction potential is highest for industrial and commercial consumers [8,9], the potential benefits that can be achieved by optimising DSM participation among residential consumers cannot be understated.[5] DSM can be particularly impactful for households because contrary to industrial and commercial loads that are often application-specific, residential demand is primarily shaped by a small number of energy-intensive domestic appliances that have widespread market penetration and regular use [14]. The number of individual end-users also tends to be higher in the residential sector, so there is sizable scope for improving DSM participation rates en masse. It is perhaps unsurprising, therefore, that utilities are increasingly promoting consumer uptake of automated demand management solutions that directly target the discretionary load of domestic electrical appliances in residential dwellings, with the aim of reducing usage during peak periods and/or shifting usage to off-peak times. Such solutions are seen to offer a highly replicable means of controlling peak demand across the residential sector, with significant potential for widespread uptake and usage.

Direct load control (DLC) devices are one such solution. Broadly speaking, DLC technology allows utilities to remotely manage demand for electricity by directly modifying the operation of end-use devices – typically air conditioners, pool pumps and electric hot water systems. Ordinarily, DLC programs involve a utility or system operator installing equipment (e.g., radio-controlled device, known as a 'remote appliance controller') that allows them to switch specific appliances on and off for a short time during peak periods and critical events [1,15]. In return for participating, consumers are usually rewarded by way of a financial incentive such as a one-off signup payment, recurring annual payment, ongoing electricity bill discounts, or free hardware installation. DLC programs have been around since the early 1970s [16] and are arguably the most common type of demand response program [7]. This form of DSM is highly attractive for networks and system operators by assisting with more accurate planning of future investments in capacity [17–19]. From a network's perspective, the ability to control load during critical peak periods – particularly for appliances that make the largest contribution to residential peak demand – allows for more reliable demand forecasts at the localised level, by providing greater certainty over the amount, timing and location of potential energy savings. For these solutions to yield optimal long-term benefits, however, it is important for consumers to respond positively – that is, they must accept and adopt the new DSM technology, and willingly participate in load control programs that are offered to them. Clearly then, consumer decision-making and behaviour (the 'human' aspects) – in conjunction with various contextual factors and the social structure in which people operate – play an important role in determining the effectiveness of new technology and policy initiatives designed to change household energy usage [20–22].

Despite offering a range of potential benefits for consumers, utilities and networks alike, and despite ongoing technological advances with the variety and capability of DLC devices, widespread consumer uptake and usage remains surprisingly low. In the United States, for instance, a 2012 survey by the Federal Energy Regulatory Commission reported that customer enrolments in DLC programs ranged from a mere 0.11% in the Texas Reliability Entity region, up to just 14.54% in the Florida Reliability Coordinating Council region [23].[6] In terms of residential customers more specifically, although the largest DLC programs have enrolled hundreds of thousands of participants, this equates to a very small percentage of the overall population. From a consumer psychology perspective, householders may be unwilling to participate for myriad reasons such as a perceived lack of control, concerns over disruptions to one's lifestyle or comfort, limited knowledge/awareness, and – as we argue herein – a sense of distrust and scepticism. In order for industry stakeholders to improve current rates of uptake and usage – and ultimately maximise market penetration of DSM solutions across the entire residential sector – it is therefore critically important to gain greater evidence-based insights into the specific factors that underpin consumer decision-making and behaviour around DSM. That is, we need to identify and better understand the most powerful and pervasive motives that lead people toward accepting (vs. rejecting) DSM solutions and programs – something that has received surprisingly little attention to date.

### 1.2. Prior research on behavioural drivers/barriers to participation

In the academic literature, evidence-based insights on the psychological drivers and barriers to consumer participation in residential DLC programs are surprisingly sparse. Although a number of DLC field trials and pilot programs have been undertaken across the globe, the results of such studies are often limited to business, industry and government reports and conference papers rather than peer-reviewed journals [e.g., 24,25–32]. Many studies also tend to focus more heavily on the technical, economic and market-based drivers and barriers for growth in the residential demand response market [7], with comparatively less focus on examining the psychological factors (i.e., cognitions, emotions, behaviours) that shape consumer responses. Furthermore, while recent years have seen greater recognition of the 'human' aspects, in such cases this is often more exploratory research that is not designed in a way to allow *causal* conclusions to be drawn. For example, very few scientifically rigorous studies have been conducted to identify the causal factors (predictors) and contingencies (moderators) that explain why people respond to DSM solutions like DLC in a certain way. As such, some questions remain over exactly what motivates consumers to participate (or not) in DLC programs, as well as how, when, where, why and for whom such motivations apply.

To confidently answer such questions about causality, a robust experimental design is required [for further discussion on the value of experimentation, and the criticality of randomised

[3] For detailed reviews of recent demand-side developments, and the benefits and challenges of demand response, see [3,4].

[4] More specifically, EE measures are designed to encourage consumers to *reduce overall energy usage* (i.e., 'load reduction') via efficiency actions (e.g., one-off behaviours such as purchasing new energy-efficient appliances, installing insulation/retrofits, etc.) and/or curtailment actions (e.g., everyday behaviours to conserve energy, such as switching off appliances when not in use, adjusting thermostat levels, etc.). DR measures are designed to *transfer consumer load from peak to off-peak periods* (i.e., 'load shifting'), usually by rewarding consumers for reducing electricity demand during certain times.

[5] DSM in the industrial and commercial sectors is not the focus of this paper. However, there is a growing body of literature available for readers who are interested in this area (e.g. [10–13]).

[6] Note that these figures pertain to all retail customers, i.e., any purchaser of energy that consumes electricity for residential, commercial or industrial use, or a variety of other end-uses [23].