Demand Response and Appropriation of Smart Grid by Residential Consumers

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Introduction

Residential consumers are one of the main unknowns of smart grid development. They are however often considered as important actors, or co-managers of the grid. Smart metering (SM) and demand response (DR) are the main elements through which consumers are today involved in smart grids. DR refers to different actions that can be taken by consumers to modify their electricity usage in response to a signal that reflects special conditions within the electricity system (such as high prices or risk of grid congestion). Residential consumers represent a large potential of peak shifting/shaving, although its dispersion entails high transaction costs. Consumers are certainly *involved* in the grid, but how to *engage* them in its management?

This poster assesses DR instruments from the point of view of households. Residential consumers are regarded as an assemblage of appliances and human(s). Uncertainty about "who should do what and when" arises partly from this distributed agency, but also from the diversity of consumers' interests in energy management. It is important to observe the theoretical assumptions that frame DR instruments: approaches will vary whether consumers are considered as rational, comfort seekers or experimenters.

How to Assess DR Potential for Residential Consumers

The demand response potential depends on three factors: the shifted power by action taken, the number of actions in a household and the number of involved households.

The number of involved households asks the question of recruitment. As the smart metering case shows, people who opt in for participating to pilot project represent about 5-10% of the total population and are consumers already interested in energy management. Results from these pilots are then biased and cannot been directly generalized to the whole residential sector.

The success of DR programs depends also on how consumers will react to different DR tools and which actions will be taken. DR tools are today mainly economic (e.g. dynamic pricing) and technological (direct load control), and rest upon contradictory figures of consumers (rational or lazy). Furthermore, the number of actions is limited to appliances that use a big amount of power (HVAC; hot water). Other appliances (dishwashers, washing machines, fridges, etc.) are considered as a future target whereas their DR potential is not clear.

Power reduction for each action is usually the result of a trade-off between economical incentives and comfort reduction. We have to notice that DR does not lead generally to energy conservation but rather to load shift.

In the perspective of increasing intermittent sources of electricity, we can view DR as the beginning of a deeper involvement of consumers in grid activities. However, as the value of electricity will be increasingly time-dependent, it is crucial to design new tools in order to enroll users that may have different interests in energy management. In surveys and in practices, residential users show a diversity of reasons to be interested: environment conservation, technology trial, energy autonomy, etc. Current DR programs clearly lack other than economic approaches to convince consumers that they are part of the grid.