Intelen

ENGAGING PEOPLE TO RETH!NK

DR Events: A Behavioral Approach

Where other approaches fail, targeting to behavioral change can be the key solution for effective DR

In 2014, the European Commission announced the 2030 Energy Strategy framework that among others included three core objectives for sustainability. The first implied a 40% emission reduction compared to 1990 levels. The second was about an at least 27% share of renewable energy sources, while the third suggested another 27% energy savings compared with the business-as-usual scenario . Hence, it's turn easy to foresee that these targets will have a great impact on the expected development of electricity generation, but also on the evolution of demand.

Since the electric system should start depending more on renewable energy sources and less on fossil fuels, a new challenge emerges. How energy consumption will be higher in moments when more renewable electricity is being produced, while it will be more restricted in times when gas-fired or coal-fired power plants exceed a lot the renewable production? This question is particularly critical for the residential sector that ranks as the second highest source of energy consumption with 26.8 % of the total based on tonnes of oil equivalent, following the transportation sector with a respective percentage of 31.6% .

The answer is simple, though difficult to be implemented. Demand response is synonym with the adaptability of the electricity demand to the availability of supply. At its core, demand response aims to deteriorate pointless energy consumption that exhausts the installed generation capacities, especially during hours of increased power consumption, and so reduce carbon emissions too. Along with providing flexibility and ensuring the reliability of the electric system, demand response can be a direct source of revenue for both energy providers and households.

Disregarding the improvements in system's reliability improvements, the economic benefits and the potentials for sustainability, responsive demand can't be as accepted as it should be. In Europe, demand response is still immaturely developed and it will take a long until demand response is being treated as the bilaterally beneficial solution for energy savings and efficiency. However, it is imperative to consider the development of demand response, if Europe wants to seize the opportunity for a more sustainable world.

As far as the residential sector is concerned, DR basically falls into two categories. The price-based demand response and the controllable demand response . Price-based demand response incentivizes households by exposing them to a time-varying electricity rate, also called a dynamic rate. From this perspective, demand response attempts to actively engage customers in modifying their consumption in response to pricing signals. Real-time pricing (RTP) and critical

- http://ec.europa.eu/energy/en/topics/energy-strategy/2030-energy-strategy
- http://ec.europa.eu/eurostat/statistics-explained/index.php/Consumption_of_energy
- http://www.brattlegroup.com/_documents/UploadLibrary/Upload937.pdf

peak pricing (CPP) are both examples of such pricing methods that actually reflect either fluctuations in wholesale/retail prices or are related to system contingencies. On the other hand, with controllable demand response, the program sponsor has agreed to remotely shut down or cycle the customer's electrical equipment on short notice.

These can be more cost-effective alternatives compared to adding generation capabilities to meet the peak and/or occasional demand spikes. However, both fail in scalability and rarely induce the expected results, especially in the long-term. Not to mention that such programs are difficult to be implemented in European countries where regulatory barriers still remain the pain that hinders market growth of demand response.

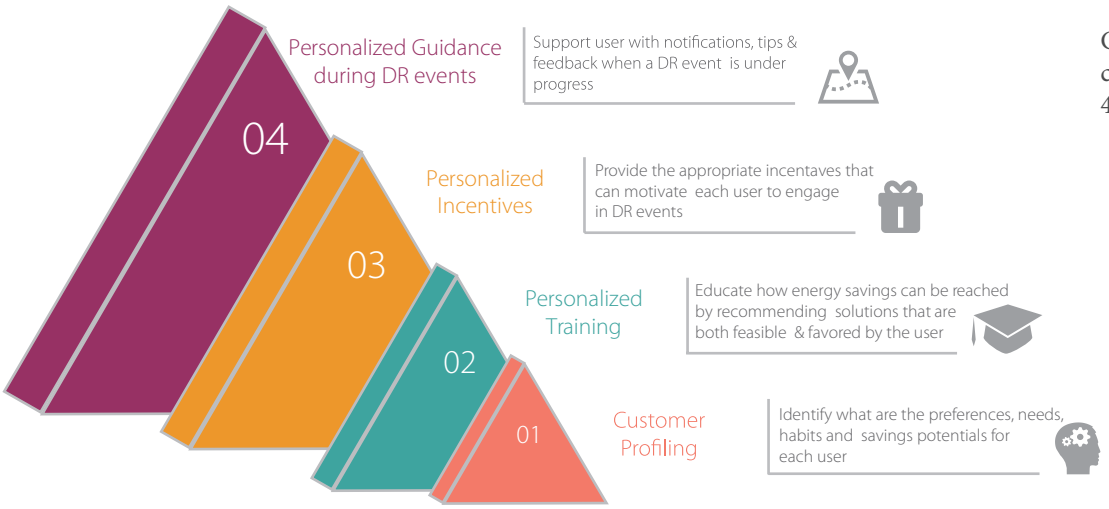
What misses from these approaches, is the behavioral aspect that targets straightforward to the curtailment behavior feasible to be built after suitable training.

Cultivating a curtailment behavior

Intelen has deployed a behavioral framework for demand response and peak demand management for residential customers, on which DiG platform is built. This behavioral approach aims to cause awareness, train and eventually produce not only positive but also sustained results in the long-term.

In order to identify best practises, Intelen constantly updates its knowledge by testing offline, multiple effects that can promote demand response and be effective across all different customer profiles that constitute utilities' clientele. Among others, Intelen sets under investigation the effect of post- DR event and real-time feedback, the correlation of incentives with sustained results, the duration of a DR event in relation to effectiveness, multiple training processes that could lead to behavioral change, the variability of energy pricing as a sufficient condition for energy reduction and the potentials of personalization across all actions taken to manage DR.

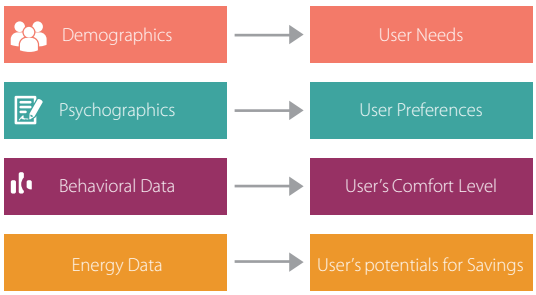
The analysis of this data supports Intelen in discovering motivational factors that should participate in a strategy map for DR management. Then, by leveraging users' profile with research insights, Intelen can develop unique behavioral DR mixtures that can fit any customer profile, ensuring the maximum effectiveness of DR events.



Curtailment behavior can be reached following 4 simple steps

Customers' Profiling

DiG utilizes multiple data sources to better understand its users and deliver solutions as personalized as possible when DR events are about to come and their effectiveness matters. Starting with customer segmentation and customer profiling techniques on the collected data, a range of identified factors and measures turns the fuzzy picture of users' preferences, habits and potentials for savings into an explicitly written manual. When needed, the customer segments are further processed to break down into micro-segments before the DR strategic map is being determined. It is only then that the behavioral framework can add value by engaging DiG customers into the DR goals. Because only by adapting the training material, notifications, real-time feedback and rewards to what each customer needs, a DR event can be successful with high effectiveness

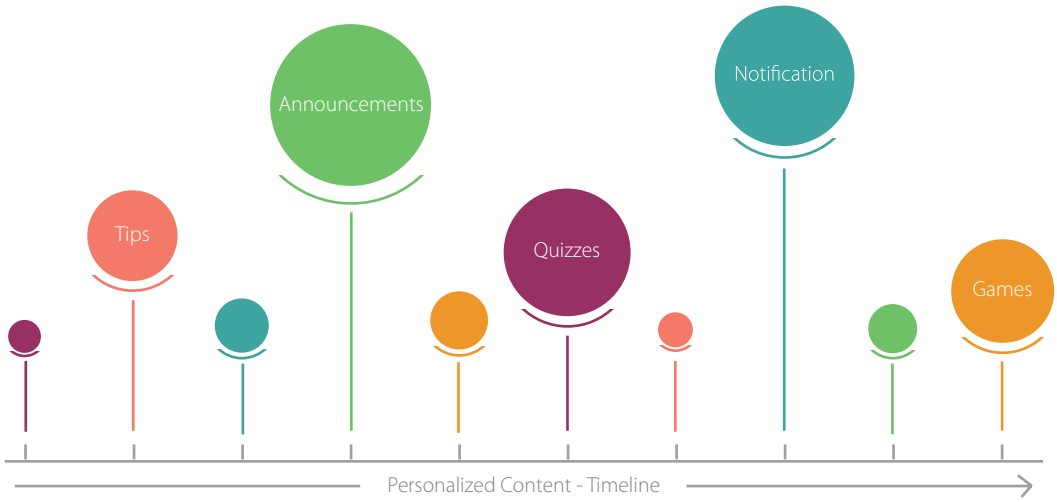


Personalized training

Training is fulfilled through a set of actions. Rich material for energy savings expressed in the form of tips, smart quizzes that both challenge and educate, and articles about the multiple benefits of DR delivered through announcements, are just some of the content sent to increase customers' awareness and trigger them to actively participate in DR.

However, apart from the theoretical background, DiG also promotes the task-based learning by engaging its users to games that can significantly contribute to behavioral change. These games differ in scope and some of them are closely linked to real DR events' objective. All games are designed to maximize user's perceived satisfaction from the gamified experience and reward participants based on their performance.

Users' training progress and commitment with the material is tracked and then reverts back as feedback. The purpose of feedback is a way to further motivate engaged users by acknowledging their interest and efforts. For users with low performance, feedback again can increase motivation by urging them to take action and follow what other, most efficient peers, do.



Effective DR can be fulfilled through the suitable training material

However, all this actions are first filtered through a rule-based system and personalization algorithms to make sure that the suitable content will reach the proper user.

Personalized incentives

Providing incentives that meet customers' preferences and needs is undoubtedly one of the factors that can significantly affect the effectiveness of DR events. In many cases, the monetary savings from a reduction in consumption cannot stand alone as a sufficient condition for committing in DR. The reason is that either the profit margins from savings are indeed quite low, or they are perceived as low enough to worth trying for a behavioral change.

While can be intriguing and occasionally elegant, neither "nudge" is sometimes enough to satisfy the urgent quests for energy reduction, when tangible incentives are absent. Because consumers are not even willing to re-think whether their energy consumption pattern is aligned with their true comfort level and not just the outcome of years and years of irrational habits, if they don't first experience some benefits.

Considering these facts, DiG has adopted a rewarding system that can fully support rebates, prizes, bill discounts and redeemable points as some of the tangible incentives that can motivate consumers to re-think and re-define their possibilities for efficiency. Again, DiG is designed to allow the personalization of incentives so as to prevent from sub-optimal offerings that lack in producing the coveted conscious behavioral change. offerings that lack in producing the coveted conscious behavioral change.

When it is DR event time

Training on DR issues might be the first key-step that utilities have to take to involve households into DR. Though, without being able to support and guide consumers when a DR event is under progress, the results can be quite disappointing.

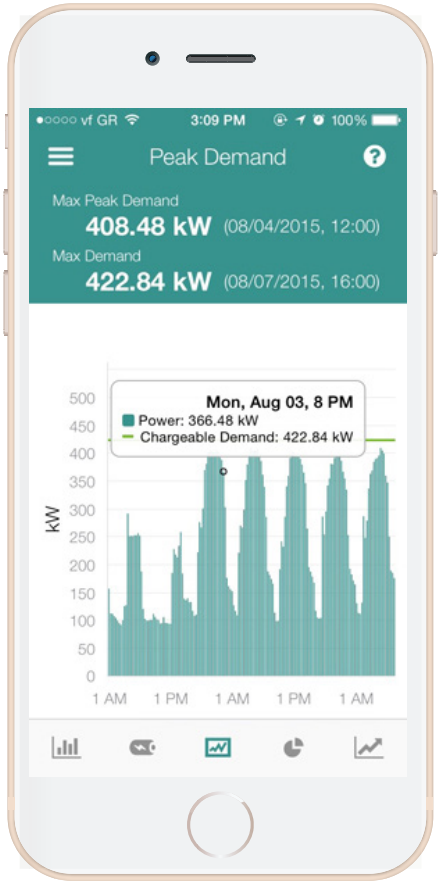
DiG utilizes a notification system to prepare consumers for a forthcoming DR event. To enable consumers with an installed smart meter to assess their contribution, DiG can deliver personalized real-time feedback that includes the actual consumption since DR started and the percentage of savings compared to the baseline along with a couple of personalized tips for further savings. If there is no an installed smart meter, DiG forwards tip message while DR event is still running and a post-event feedback message to inform consumers about their performance.

Apart from that, DiG platform has a dedicated section that users can visit to see in detail their consumption in KW and monetary value in order to observe the behavioral change of their energy usage. In this section, a functionality called "Peak Demand", contributes to time-based pricing.

With only requirement the installation of a smart meter or the existence of very frequent energy data samples, this module can accurately recommend users the

most suitable pricing package with the lower hired power from the utility's available ones. By leveraging an advanced peak-algorithm and the users' actual hired power, DiG accounts for the calculation of the number of shots exceeded and informs users about the number of these shots. If the user takes into consideration the system recommendations and the number of shots changes, this alone can stand for a behavioral change. Recommendations are constantly updating and dynamic pricing becomes a reality due to DiG.

Moreover, DiG is compatible with thermostats' installation through APIs and so controllable demand response can acquire a more dynamic dimension by combining the strongest software and hardware capabilities for more efficient results.



Analytics

The overall progress of the training phase and the effectiveness of the DR events can be easily tracked by utilities through analytics. With the metrics and KPIs that DiG admin platform provides, utilities can gain valuable insights and re-define the schedule of future DR events, if necessary.

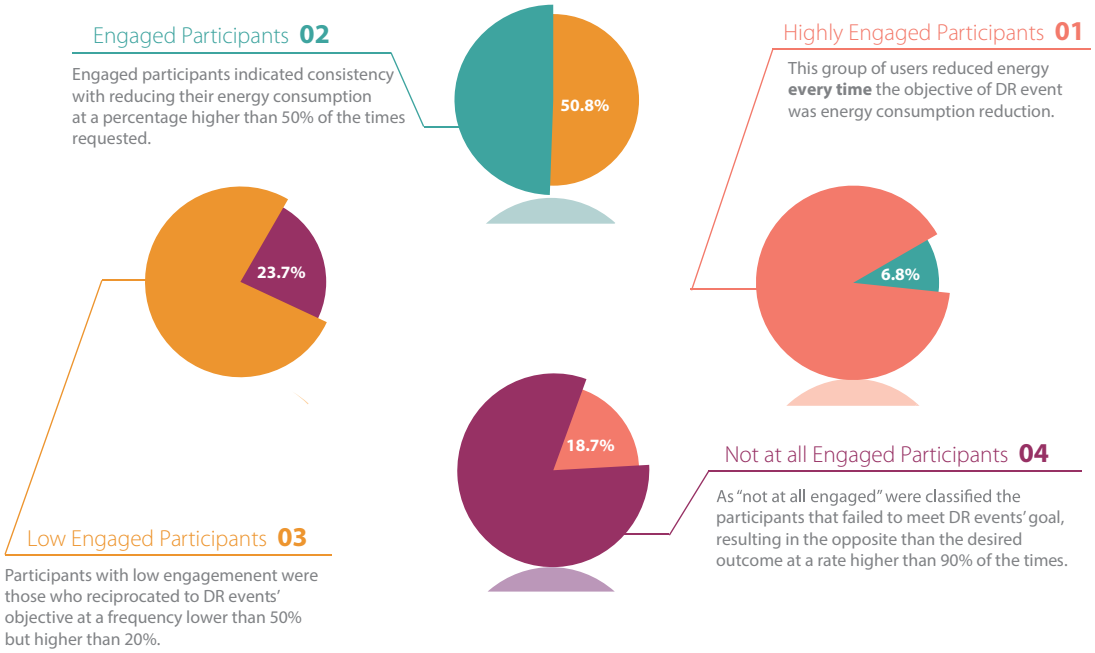
Participation, total energy savings and the sustainability of results are just three out of the multiple interests that utilities might have and DiG can answer. Below, the engagement level through the course of 10 DR Events, is presented.

Case Study: Estimating the Engagement level of Users

From 29/05/2015 till 21/07/2015, Intelen in partnership with a DSO in Crete, Greece, run 10 DR pilot events across 80 participants. The scope of the project was to assess the pure engagement level of participants. Invitees had no other incentive but to voluntarily participate to the DR events, trying to reduce their consumption as much as possible. The only effect involved was a kind of training as the messages sent to participants were also including some smart ways for energy savings. No economic or other incentives were provided.

Participants were clustered based on their consistency to perform energy savings when requested. The results revealed four different levels of engagement reported as "Highly Engaged Participants", "Engaged Participants", "Low Engaged Participants" and "Not at all engaged Participants" that correspond to the 6.8%, 50.8%, 23.7% and 19.7% of the entire sample population, respectively.

The savings' level of these groups also differed, with highly engaged participants showing on average more than 6% savings across the 10 DR events, while engaged users indicated an average close to 1%. The rest two groups had no savings compared to the typical consumption since fluctuations did not allow savings to exceed.



Consumers' consistency on performing savings across DR is a critical engagement metric

Considering this results, Intelen run further analysis on user's demographics and psychographics to realize the true reasons behind user's difficulty to reduce their consumption and then deployed more sophisticated approaches to motivate even the most demanding consumer.

The results were astonishing.. Stay tuned to learn more!

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