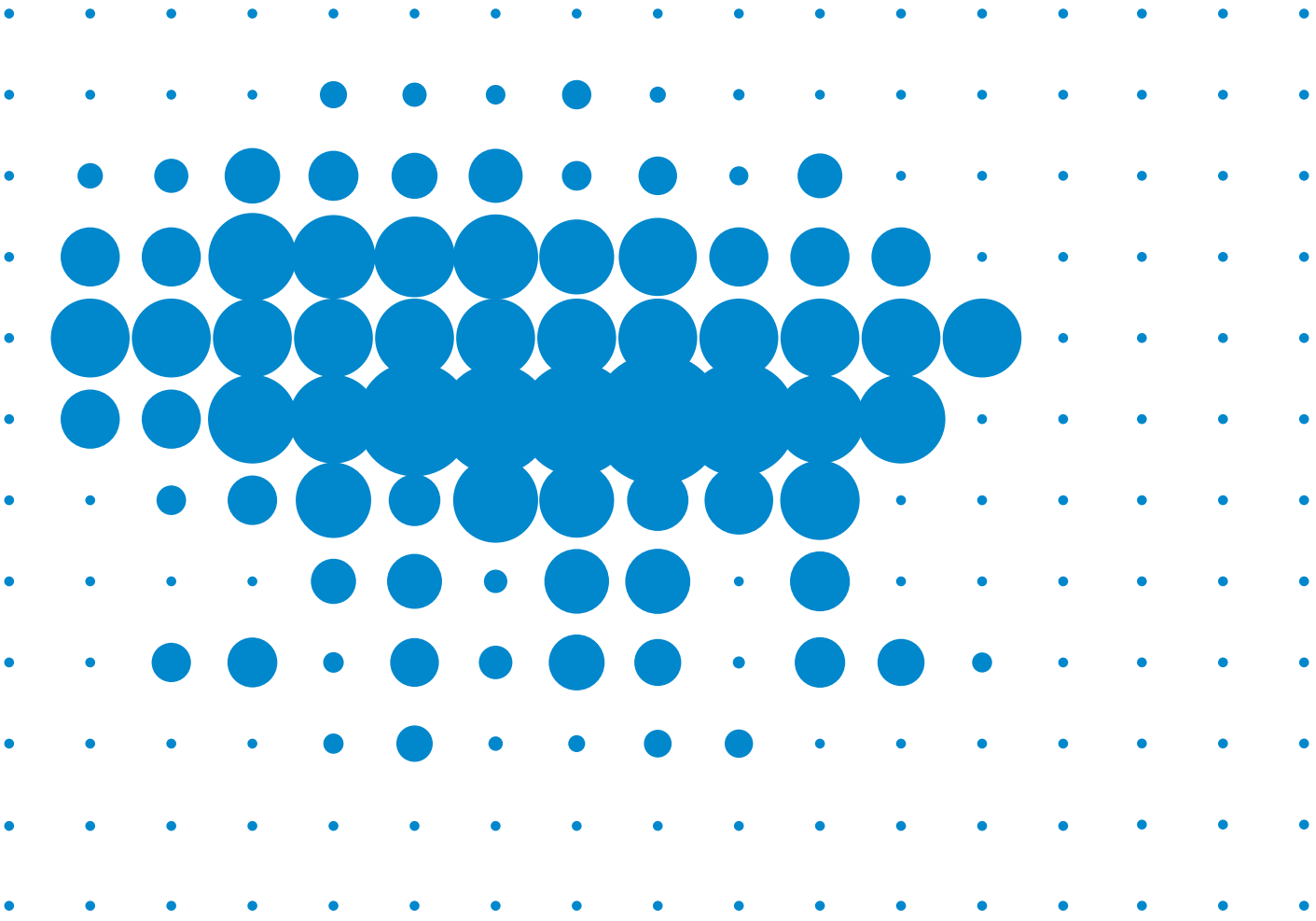
ONZO®

Whitepaper:

End uses of Load disaggregation



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01 WHAT IS LOAD DISAGGREGATION?

What Load Disaggregation does

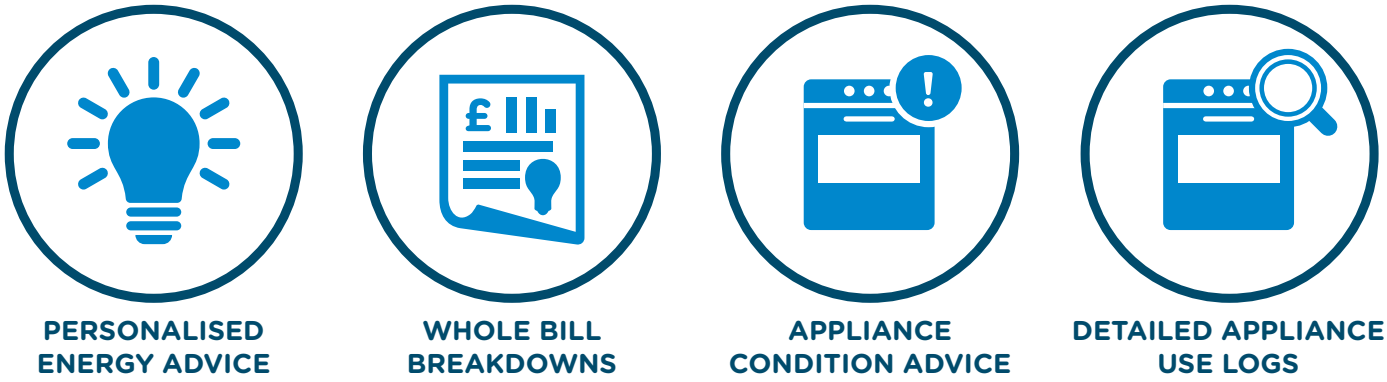
Load Disaggregation is a broad term covering a range of techniques able to split a household's energy consumption by the individual appliances used. It offers insight into consumers' end use of electricity (or gas or water) using data from a single meter, without the need to install measuring equipment on individual appliances.

Despite having roots in the 1980s, Load Disaggregation has until now remained a largely academic topic, with little successful application in the utilities industry or with end consumers. In large part this has been due to the lack of available data and the complexity of the analytics. However, the roll out of smart meters is providing more widespread access to granular consumption data, and with growing maturity of Load Disaggregation solutions, the key question which remains to be answered is: How can disaggregated usage data drive value for the customer and utility?

The end uses of Load Disaggregation

Economic and social drivers mean today's consumers are becoming more conscious about their energy footprint, yet the residential sector still contains significant un-tapped energy savings. The tools that are widely available to end consumers do not help them to identify potential savings within their usage. Load Disaggregation can offer consumers greater visibility of where they are using energy within the home and where the potential savings lie. ONZO have identified four key end uses for Load Disaggregation in helping customers to manage their energy use:

Customer end uses



- *Detailed appliance use logs* – presenting to the customer what appliances they used and when, and the associated energy usage and cost. Typically these take the form of an energy use time-line with appliance use highlighted, or selected set of major events.

- *Personalised appliance-level energy advice* – providing the customer with actionable tips on how to save energy, personalised to them based on their observed appliance use. Messages could be communicated via web, phone or bill, and offer guidance such as "You are using your washing machine at peak times. Switch to before 7pm to reduce your bill".

- *Whole bill break-downs* – helping customers understand what they are spending money on by showing their bill for a week, month or year, broken down by what their energy was used for, or a list of 'top use' appliances.

- *Appliance condition advice* – offering the customer information regarding the relative efficiency of their appliances, or early warning of faults such as "It looks like your freezer is not operating normally; it may need servicing".

All of the above end uses help consumers by encouraging behavioural changes that will target their time and efforts on the actions and areas of consumption likely to yield the greatest financial and energy saving benefit.

Load Disaggregation also provides utility companies the opportunity to gain new insights about their customers based on their appliance usage habits. ONZO has identified the following key end uses for Load Disaggregation in helping utilities:

Utility end uses

- Enhanced customer intelligence – increasing knowledge about the customer, how they use energy and the appliances that they own, which is usable throughout the organisation such as for making customer content more informed and personal.

- *Customer segmentation* – making use of information on customers' energy use habits to supplement existing demographic segmentations. This in turn can be used to enable more informed strategic and tactical decision making.

- *Targeted marketing and messaging* – enabling outbound communications to be targeted at customers who meet certain criteria such as ownership of a particular appliance or exhibiting a particular lifestyle inferred from their appliance usage.

- *Targeted demand response* – identifying the likely shift-able load through understanding of end consumers' appliance usage.

These utility focused end uses seek to make processes more efficient and effective through targeting a tighter group of customers, and in so doing reduce expenditure and help enhance revenue generation.

02 WHAT TYPES OF DATA ARE AVAILABLE?

Consumption data

To achieve the end uses of Load Disaggregation identified previously, energy consumption data is required. This can take many forms, and not all of these are suitable for use with all Load Disaggregation techniques.

Traditional meter data

Traditional meters continuously count the total consumption of a household. Without the ability to report the usage back to the utility these meters are often referred to as “dumb” meters and require a manual meter read be completed, typically at 3-6 month intervals.

Traditional meter data is therefore highly sparse, prone to error from manual reading, and gives no indication of when the energy was consumed during the intervening period.

Smart meter interval data

Smart meters automatically measure consumers’ energy usage far more frequently than dumb meters, typically every 15-60 minutes, although this can be daily. The consumption data is electronically recorded and transmitted back to the utility company without the need for a meter reader.

Through being automated Smart meter data is consistent in content and frequency without the opportunity for human error. Smart meters present utility companies with much more data, which provides both greater opportunity to derive insight but also requires additional resources to store and process.

Smart Plus device data

Smart Plus devices provide data which is of much higher resolution than Smart interval data. They are supplementary devices, and either take the form of ‘energy hubs’ which attach to a Smart meter to capture and transmit the data, or secondary sensor devices installed in addition to the meter.

Measurements are typically recorded every 1-60 seconds and often include instantaneous power readings, as well as energy readings.

Smart Plus device data is highly detailed and provides the opportunity to obtain the greatest information into consumers’ usage. However, the additional hardware introduces expense and, as with Smart meter data, the

challenge for utility companies is to gain usable insight from this vast resource.

Additional data

In addition Load Disaggregation techniques can benefit from making use of:

- Household profile data, detailing the appliances known to exist in the home. This is often “claimed” from customers when they set up a profile online.

- Consumers’ feedback on the accuracy of the Load Disaggregation results.

03 WHAT OUTPUTS CAN LOAD DISAGGREGATION ENABLE?

The table below shows the outputs which Load Disaggregation can enable for each of the eight end uses described above *(The End Uses of Load Disaggregation, p1)*.

		Traditional	Smart	Smart Plus
CUSTOMER END USES	**Whole bill breakdowns**	Seasonal proportion of heating and air-con only	100% personalised breakdown of usage into activities within the home	Supplement breakdown with smaller appliances
	Personalised energy advice	Seasonal usage and generic messages only	Personalised engagement based on behavioural analysis and major appliance use	Additional messaging on use of smaller appliances
	Detailed appliance use logs		Use of major appliances that have the largest impact on load including air-con, pool pumps and heating	Use of additional smaller appliances such as washing
	Appliance condition advice		Comparisons and advice for condition of air-conditioning & heating	Comparison of performance of smaller appliances such as fridges / washing machines
UTILITY END USES	**Enhanced customer intelligence**	Understanding of seasonal air-con and heating use	Profiling of customer behaviours from activities and main appliance use within the home	Intelligence of certain lifestyle aspects based on smaller appliance use e.g. time of washing use
	Customer segmentation	Basic segmentation on seasonal breakdown	Detailed customer segmentation on activities within the home	Further segmentation of small appliance use
	Targeted marketing and messaging	Limited to seasonal profiling	Personalised and targeted based on detailed knowledge of activities including air-conditioning use within the home	Further targeted engagement based on small appliance use
	Targeted demand response	Based on proportion of air-con or heating use only	Effective targeting based on behavioural understanding of household activities and use of major appliances	Supplementary targeting of programs on lower consumption appliances

04 ABOUT ONZO

ONZO combines the science of energy analytics with load disaggregation, energy lifestyle behaviour analysis and probabilistic forecasting to give utilities and their customers unprecedented insights into how, where and when energy is used.

Our patented algorithms analyse smart meter data at any available granularity. In addition to identifying appliance use in each home, our unique approach breaks down consumer behaviour patterns and lifestyle characteristics to help utilities understand 'why' each customer uses energy the way they do.

These insights are converted into personalised tips, advice and goals/challenges for the customer to empower them to take control of their energy use. By delivering this level of transparency and visibility, we help customers understand why certain appliances and behaviours drive up costs and help them learn how to productively change their consumption habits.

For utilities these smart insights strengthen operational efficiency by reducing pressure on call centres and improving the planning of field operations. It also increases net profit from marketing campaigns through superior targeting and segmentation capability. Demand response and energy efficiency campaigns have a much higher probability of success when targeted towards customers best positioned to action them.

By redefining the customer – utility relationship through better transparency and personalised engagement ONZO converts disengaged consumers into informed customers who help utilities address modern business realities. This allows utilities and customers to work together to build tomorrow's energy future.

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