Designing fair and equitable market rules for demand response aggregation

A EURELECTRIC paper

March 2015

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Designing fair and equitable market rules for demand response aggregation

A EURELECTRIC 2015 paper *March 2015*

EXECUTIVE SUMMARY

Demand response (DR) will be one of the building blocks of future wholesale and retail markets, offering electricity customers the opportunity to reap the full benefits of their flexibility potential. The development of innovative demand response services will empower customers, giving them more choice and more control over their electricity consumption. Phasing out regulated retail prices and rolling out smart meters continue to be key prerequisites to advance demand response further.

Suppliers have long been key players in the field of demand-side flexibility and EURELECTRIC believes that they are best positioned to offer the competitive, efficient and simple demand response services that customers need. Meanwhile, demand response aggregators are entering several European electricity markets.

In order to ensure that customers can access the full benefits of demand response aggregation and do not face undue costs, this paper sets out proposals how to develop a robust, transparent and equitable market design for demand response aggregation in wholesale and retail markets.[1] This market design should ensure a level playing field for all demand response providers as well as a clear and fair allocation of the benefits and costs incurred.

Some demand response providers act as third party aggregators, contracting directly with customers for demand response services and selling aggregated demand response products on the wholesale electricity market. A lack of clarity on their roles and responsibilities towards other market parties (i.e. customers, BRPs/suppliers and TSOs/DSOs) could leave room for free-riding, thereby increasing costs for customers. In the interest of a future-proof demand response environment, EURELECTRIC recommends:

1. Ensuring that the demand response value is market-based in order to avoid any extra costs to the system, customers and other actors.
2. Implementing adequate communication between third party aggregators and BRPs/suppliers to ensure that demand response can take place effectively.
3. Ensuring that BRPs/suppliers are compensated for the energy they inject and that is re-routed by third party aggregators. To this end, third party DR aggregators and suppliers agree on the rules of compensation. Changes in market rules and settlement adjustments could also be implemented. In addition, a clear balance responsibility of third party aggregators is needed.
4. Ensuring that, on a commercial basis, BRPs/suppliers are able to renegotiate supply contracts to take into account the indirect effects of demand response (e.g. rebound effects) and consequent impacts on sourcing costs.
5. Facilitating demand response aggregation at distribution network level through information exchange between DSOs, TSOs and aggregators, for example using a system that reflects network availability.

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[1] In line with the recommendations of the recently published Task Force Smart Grid Expert Group 3 report on flexibility

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1. Introduction: Demand response and its challenges

Demand response (DR) will be one of the building blocks of future wholesale and retail markets, offering electricity customers the opportunity to reap the full benefits of their flexibility potential. The development of innovative demand response services will empower customers, giving them more choice and more control over their electricity consumption. Such services can either take the form of time-varying prices or of incentives specifically rewarding customers for changing their consumption patterns.

The procurers of this flexibility are Balance Responsible Parties (BRPs)/suppliers for portfolio optimisation as well as network operators who may use flexibility as a new tool to ensure the secure operation of their grids. In line with the Energy Efficiency Directive, EURELECTRIC believes that demand response, including aggregated demand response, should be able to participate in all markets on a level playing field, alongside other sources of flexibility such as supply assets and storage.

Demand response aggregation gathers customers' demand response to build electricity products that can be traded. Whereas European electricity markets are set to become more integrated, different models for demand response aggregation exist in Europe. For instance, aggregators can either be suppliers or third party market participants.

Suppliers have long been key players in the field of demand-side flexibility and EURELECTRIC believes that they are best positioned to offer the competitive, efficient and simple demand response services that customers need. Meanwhile, third party aggregators are entering several European markets. EURELECTRIC sees a lack of clarity on their roles and responsibilities towards other market parties (i.e. customers, BRP/supplier and TSO/DSO), which could leave room for free-riding, thereby increasing costs for customers.

In February 2015, after a year of fruitful stakeholder debate, the European Commission's Task Force Smart Grids Expert Group 3 published its "Regulatory recommendations for the deployment of flexibility", with a strong focus on demand-side response aggregation. EURELECTRIC was actively involved in this process and would like to contribute further with concrete and constructive proposals to develop a robust, transparent and equitable market design for demand response aggregation.

At the same time, EURELECTRIC acknowledges the diversity of European electricity retail markets. The proposals developed in this paper regarding third party demand response aggregation may therefore not fit all national retail markets, especially those where deregulation is in place and the roll-out of smart meters has been completed.

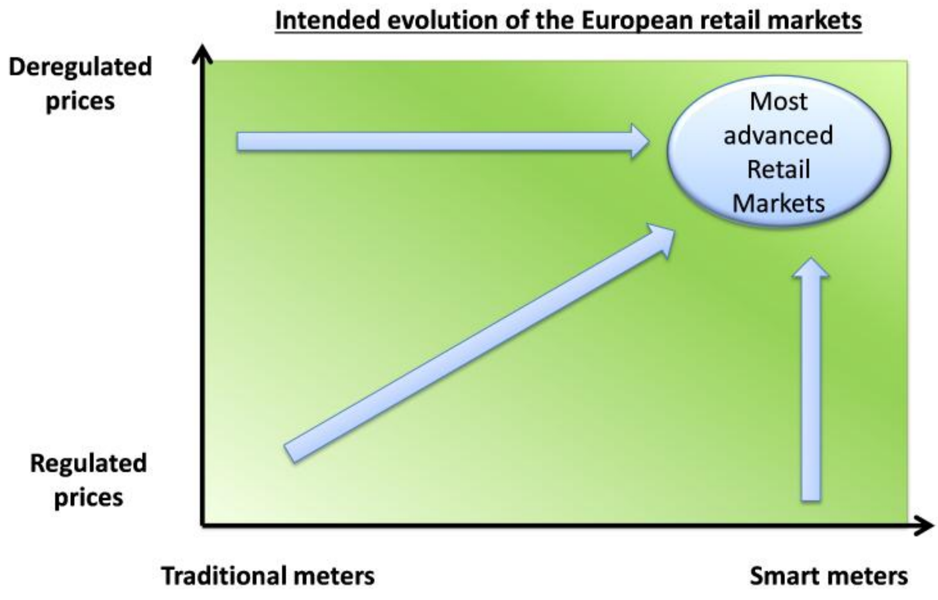


Figure 1: Intended evolution of the European retail markets

With this report, EURELECTRIC strives to explain what demand response and aggregation are and how technological developments and innovation would contribute to their deployment (Part 2). Part 3 assesses the different market models that can be put in place to ensure the development of demand side flexibility as well as the impact of demand response aggregation actions on other market parties in a context of missing contractual and operational relationships. Part 4 proposes different options for such contractual and operational relationships between actors as a way to close existing loopholes and ensure that costs and benefits of third party demand response aggregation are allocated correctly. Finally, the paper makes a number of recommendations, based on the advantages and drawbacks of the various options considered.

2. Demand response and aggregation

2.1 Definitions

Demand response encompasses a series of voluntary, remunerated actions by final customers, either automatic or manual, aimed at changing their electricity consumption or generation in response to price signals (e.g. time-varying electricity prices) or aimed at bidding in organised electricity markets directly or through demand response aggregation (done by supplier or third party).

Figure 2 shows a consumption shift: the consumer reduces consumption at a certain point in time and shifts it to a different moment. In doing so, a ‘rebound’ effect can occur, for example when increased electricity consumption is needed to catch up with the previous decrease.[2]

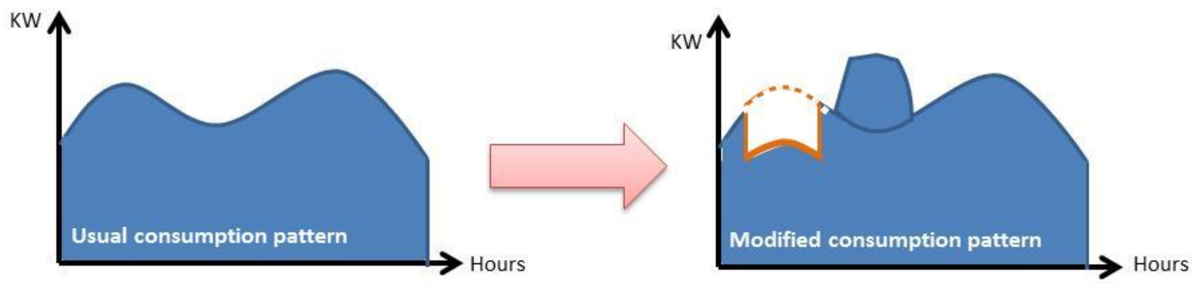


Figure 2: A simplified overview of demand response

The Energy Efficiency Directive (2012/27/EU) has provided a legal basis for further development of demand response in Europe. It requires enabling demand response to participate alongside supply in wholesale and retail markets, including balancing and ancillary services provision, according to its technical possibilities. Moreover, the European network code on electricity balancing should enable the provision of balancing reserves from system users connected to distribution networks, including the aggregation of small demand units (alongside with generation units).

Efficient demand response is nothing new: it has long been incorporated in supply contracts[3] offering time-varying prices to industrial, SME and residential customers. By reflecting the price of electricity in different time periods, these offers allow customers to use less electricity (through manual changes or automation) at times of high prices and hence reduce their costs. These contracts, concluded between the customer and its supplier, can be static (time-of-use) or dynamic (critical peak pricing, real time pricing). More recently, the development of smart metering[4] has allowed suppliers to develop increasingly attractive dynamic pricing to offer best demand response services to their customers.

Next to these time-varying supply contracts, “on-demand” demand response programmes pay participating customers to modify their electricity consumption when requested (manual or automated). In the case of a consumption reduction for example, the electricity made available can be aggregated, re-routed and sold on organised electricity markets by the demand response aggregator (being the supplier itself or a third party aggregator). Aggregation is a commercial function of pooling consumption changes (but also e.g. distributed generation changes) from customers to provide energy, flexibility, capacity and services to other actors within the system. Large customers may also directly participate in electricity markets when they have the ability to provide the requested products.

[2] Demand response where consumption is increased at a certain point in time is also possible. Customers increase their consumption in reaction to the demand response signal. However, this specific case will not be addressed in detail in this paper.
[3] See EURELECTRIC’s report Retail (R)evolution – power to the customer, 2014
[4] Depending on the smart meters’ functionalities

The role of an aggregator could be taken up by a supplier or a third party market participant, depending on customer choice and market design.[5]

2.2 Necessary technological developments and innovations for further deployment of demand response

Effective demand response has been developed by suppliers without smart metering or complex IT[6], and in some cases in markets where regulated prices are still in place. Nevertheless, dynamic pricing and advanced demand response aggregation are more likely to take off when regulated retail prices are phased out. Demand response will also be easier to develop with smart meters that allow interval metering according to market standards and ensure that the amounts of kWh are settled and balanced accordingly. With these prerequisites in place, suppliers are able to offer prices to their customers that better reflect wholesale market prices and develop services to help customers react to price signals. This is the most efficient way of tapping the demand response potential as it does not require an overly complex framework. For instance, if customers' consumption is registered hourly and they are using hourly priced products, they are able to simply avoid high prices by consuming less during high-cost hours, thus avoiding the need for estimations or intermediaries.

These developments are even more necessary when aggregated demand response products are sold on the organised electricity markets. This activity requires, among other things, the definition of a baseline[7] to verify and measure the actual amount of electricity shifted by the consumer and then re-routed and sold on the market by the aggregator. A baseline is in essence an estimate. If this estimate is in turn calculated based on other estimates such as the consumption level before, during and after the demand response action (for example based on standardised load profiles), then accuracy is very limited and the risks of undue impacts on other market actors increase. Therefore, the risk of baseline error is reduced when participating customers are equipped with smart meters.

Access to customers' actual consumption data would also allow a better allocation of imbalances created by partial reaction of customers to demand response activations (see Annex 3) and help BRP/suppliers to differentiate between usual consumption changes and demand response actions of their customers.

In some countries with developed financial markets medium-sized and even small business customers are using a combination of physical purchase of spot-priced power and financial hedging products, with the help of an intermediary, e.g. their supplier, in order to stabilise their electricity costs. In such a case customers may directly offer their consumption changes to the market, for example by not using electricity and selling the relevant hedge, without using any estimated baseline.

[5] In January 2014, EURELECTRIC issued a paper "Flexibility and aggregation: requirements for their interaction in the market" that elaborated on the concept of flexibility, different uses of flexibility and the role of aggregation in unleashing the potential of flexibility in the market.

[6] For example, 7GW of demand response was available in France in the 90s thanks to time-of-use tariffs

[7] Definition of what would have been the customer's consumption if the demand response action would not have occurred

3. Different market models for demand response aggregation

As described above, the role of an aggregator would be taken up either by a supplier or by a third party market participant, leading to different market models for demand response aggregation.[8]

3.1 BRP/suppliers performing demand response aggregation

As described in Figure 3 below, the simplest scheme is one where suppliers offer demand response services to their customers and act as demand response aggregators, for instance to perform efficient internal portfolio optimisation. For example, a BRP/supplier assesses whether it is more cost-efficient to source electricity on the market or to activate demand response within its portfolio. New entrant aggregators can of course assume the role of a BRP/supplier in order to offer flexibility services[9] to their own customers' portfolio or sell directly their services to a BRP/supplier, as is the case in the Swedish example described below.

In this model, the chain of balance responsibility remains intact and delivers simple arrangements such as one main contact point for the customer. As highlighted in Figure 3, the only potential impact that would need to be specifically managed is the one on access and operation of transmission and distribution grids.

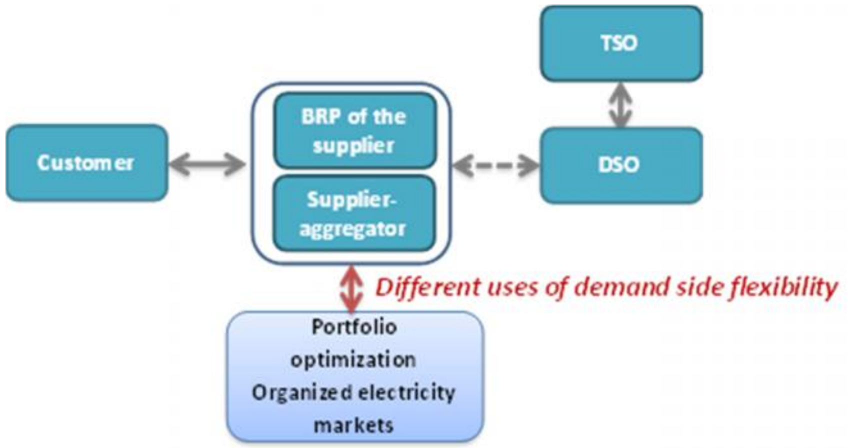


Figure 3: Links between market actors when demand response aggregation is done by supplier

Best practice: the Swedish case Sweden has completed the smart meter roll-out, giving customers access to dynamic prices offers from their suppliers. The well-functioning retail market ensures fair competition between all actors. For instance new entrants can easily become BRPs/suppliers. In this context efficient demand response can be implemented with aggregators becoming BRPs/suppliers and developing their own customer portfolio; offering their services to BRPs/suppliers on the market; or acting as technical advisors for customers and other market actors.
Developing market models for flexibility: the Universal Smart Energy Flexibility (USEF) example[10] A number of interesting initiatives have emerged in the past few years to develop interoperable frameworks for flexibility. The USEF foundation has developed a wholesale market model for flexibility. This framework includes roles and responsibilities, process flows, information flows, a traffic light system for DSO network status as well as use cases. In the USEF interaction model, the supplier and the aggregator sign a framework contract for all prosumer services provided by the aggregator. This contract defines the operating conditions for the demand response service carried out by the aggregator acting under the flag of the supplier. The aggregator and the BRP/supplier also negotiate on how to mutually optimise their portfolios and find the lowest operational costs.

[8] Obviously hybrid models are also possible, for example where aggregators sell their services to a BRP/supplier or act as consultants or technical facilitators

[9] Aggregators can also act as consultants or technical facilitators for the customer or the BRP supplier. While developing these activities they do not act directly on the wholesale electricity markets.

[10] An introduction to the Universal Smart Energy Framework: http://www.usef.info/Home.aspx

3.2 Third party demand response aggregation

In some countries the role of third party demand response aggregator has been introduced. As shown in Figure 4, third party aggregators generally contract directly with customers for demand response services *(purple arrow),* without needing the consent or agreement of BRPs/suppliers, and sell aggregated demand response on the wholesale electricity market *(red arrow).*

This activity has impacts on other market actors *(dotted grey arrow)*, which need to be addressed through contractual and operational relations between third party aggregators and other market parties. Indeed, the interactions between customers, third party aggregators, BRPs/suppliers and network operators need to be clarified regarding the adjustments to be made to existing contracts, the type of information to be exchanged and the need for new operational or contractual arrangements.

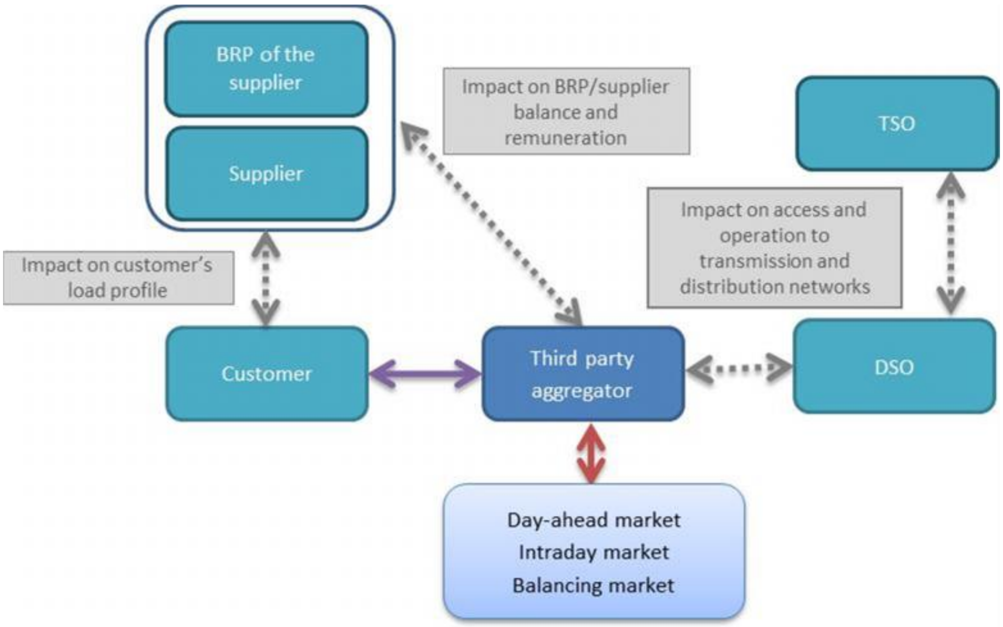


Figure 4: Impacts of third party aggregation on other market parties

<u>Impact on BRP/supplier:</u>

When a third party demand response aggregator activates a customer, this creates an imbalance in the balancing perimeter of the customer's BRP. Depending on the balancing regime, the BRP may face an imbalance penalty when the aggregator action is taken into account during the imbalance settlement. However, the BRP may also receive a payment in case of a positive imbalance.

Part of the energy injected by the BRP/supplier is not consumed and not paid by its customers when they are activated by a third party aggregator. Missing income or insufficient remuneration of this electricity creates financial risk for the BRP/supplier.

Figure 5 shows how these impacts occur. A consumption reduction triggered by a third party aggregator diverts energy from a certain pool of customers to an organised electricity market where it can be sold. As a result of the third party aggregator's action, part of the energy injected by the BRP/supplier is not consumed by its own customers but somewhere else in the system and the BRP is put in imbalance.

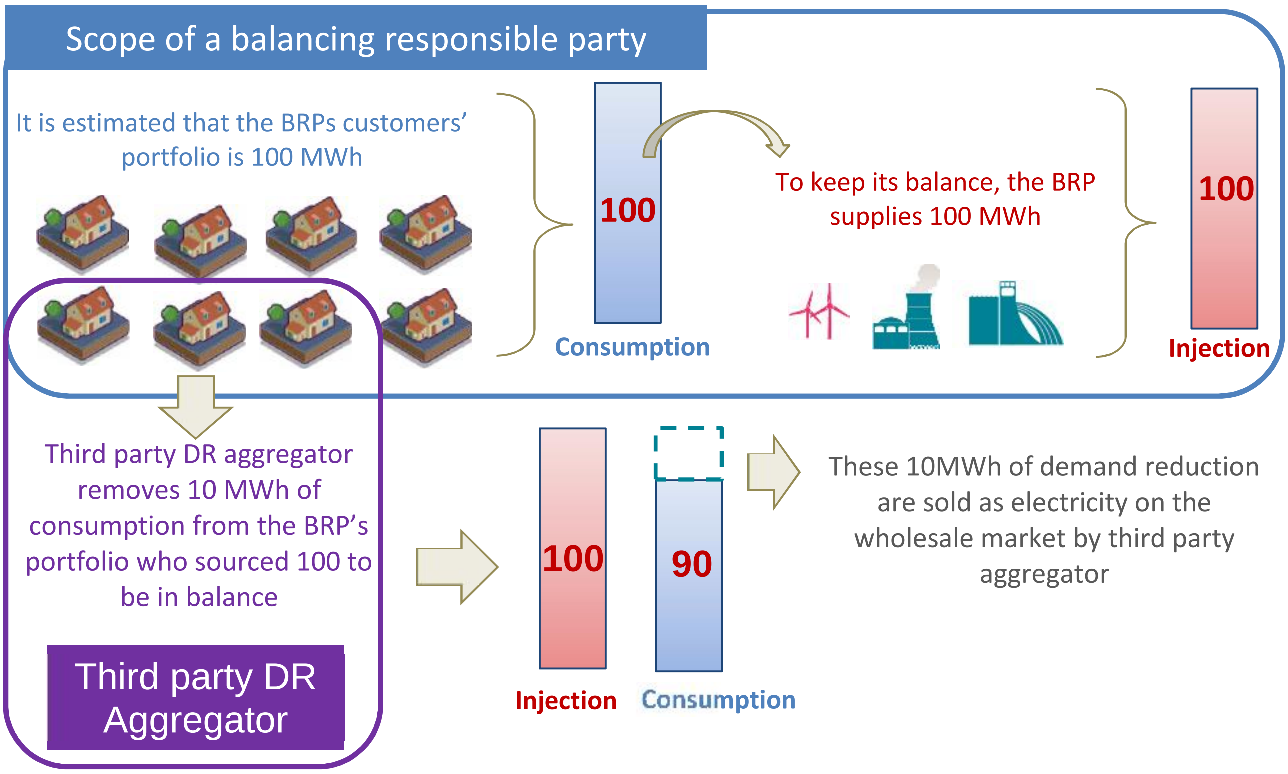


Figure 5: Example of third party demand response aggregation

<u>Impact on customer's load profile:</u>

Actions by third party aggregators can affect the consumption pattern of customers beyond what was taken into account by BRPs/suppliers when they priced their offer to these customers. For example, customers may shift their consumption to compensate for the previous decrease (rebound effect) beyond the range forecasted by BRPs/suppliers. This may incur extra imbalance costs for BRPs/suppliers as consumption goes beyond the contractual range which is illustrated in the figure below between the two red dotted lines (see Annex 2).

Figure 6: Customers' consumption patterns changes may go beyond the range forecasted by BRPs/suppliers

<u>Impact on DSO/TSO:</u>

Whilst demand response can be an effective tool for DSOs to relieve network congestions, activation of demand response located in the distribution network may lead to network constraints and affect security of supply or quality of service. Adequate procedures allowing DSOs to maintain operational security in their networks and the market to function efficiently need to be set up.

Furthermore, a robust and efficient IT framework is required to ensure the necessary exchange of information. The cost of such a framework will have an impact on aggregators' business model and should not be hidden or carried by other market parties.

4. Addressing the impacts of third party demand response aggregation on other market parties

Addressing the impacts identified above requires developing contractual and operational relationships between actors, allowing for an efficient integration of third party demand response aggregators into the European wholesale electricity markets. This section proposes several solutions, assessing different options where relevant.

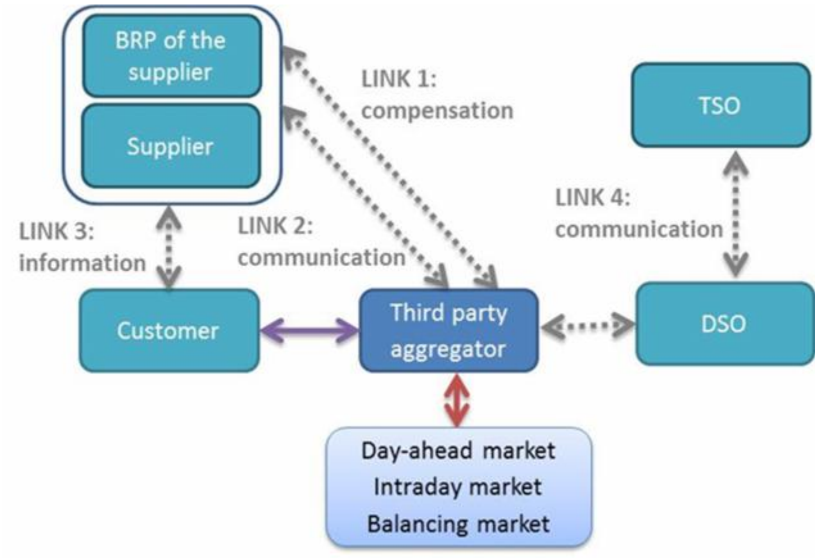


Figure 7: Links to be developed to address third party aggregation impacts

Link 1: Between BRP/supplier and third party aggregator: addressing the impact on BRP balance and remuneration

There are several options to ensure that BRPs/suppliers are compensated for the energy they inject and that is re-routed by third party aggregators. Not all, however, fulfil the conditions of a good market design.

The BRP/supplier could be compensated through **two main options**:

1 **The BRP imbalance is not neutralised and the BRP/supplier is compensated at imbalance price by the third party aggregator** through the TSO. Such a model requires that BRPs are not penalised for imbalances when these imbalances support the system. However, it introduces a significant price risk for BRPs/suppliers since they become dependent on the imbalance price for the correct remuneration of the diverted electricity. Moreover, such a market design is not well suited for third party demand response aggregators that are active on other than balancing markets. Indeed, on the day-ahead and intraday markets, such a market design would pose even greater risks for BRPs/suppliers, since third party aggregators can activate regardless of the system state, putting BRPs/suppliers in an imbalance that aggravates the system state.

2 **The BRP imbalance resulting from the third party aggregator action is neutralised by the TSO and the BRP/supplier is financially compensated for the energy re-routed** by the third party demand response aggregator to be sold on the market**.** In this way BRPs/suppliers are not entirely dependent on the imbalance price for the compensation. This second option can be divided into 3 models: a corrected model, a regulated model, and a contractual model (*see Figure 8*).

	BRP/Supplier compensation	Model assessment +/-
"Corrected model" Customers' metering data is corrected by the amount of electricity that has been sold to the aggregator	Customers remunerate their BRP/supplier at the contracted rates (e.g. commodity and level of guarantee of supply, etc.), and are in turn compensated by the aggregator.	+ Transparent pricing and minimal additional processes on the BRP/supplier side - Adjustment of metering data can result in a lack of transparency on consumption volumes for the customer - Substantial efforts for the correct follow-up of the metering data - Implementation for smaller customers may prove difficult
"Regulated model"[11] Direct compensation by third party DR aggregator at regulated price	Direct compensation of a BRP/supplier by an aggregator at a regulated price. The regulated price should at least cover the commodity and the means of flexibility subscribed ex-ante by the BRP/supplier.	+ Reduces concerns of possible market power by the BRP/supplier - Inhibits pricing innovation by the aggregator - Allows for non-market based arbitration between the regulated price and the price in the wholesale electricity markets - Regulated price does not ensure correct compensation for the BRP/supplier since this price may deviate from the price contracted with the customer.
"Contractual model" The third party DR aggregator and the BRP/supplier agree on compensation	Third party DR aggregators and BRPs/suppliers agree on compensation. Standard framework and contracts could simplify processes.	+ Standard frameworks and contracts could simplify processes for large-scale roll-out - Market power concerns on the side of the BRP/supplier, but such refusals can become a competitive disadvantage, driving customers towards competitors that do reach agreement with aggregators.

Figure 8: Different compensation models

The three models proposed in Figure 8 allow BRPs/suppliers to recover all additional costs related to the activities of third party demand response aggregators through a single channel. Overall, the "contractual model" corresponds best to the elements of a good market design. It allows for market-based pricing of energy and flexibility; it can be applied in the day-ahead, intraday and balancing electricity markets; and processes can be standardised and automated for large-scale roll-out. These contractual and operational arrangements should provide a fair sharing of the additional costs, in order to allow a sound development of

[11] Such a regulated model has been implemented in France with the NEBEF mechanism

demand side flexibility services. Alternatively, changes in market rules and settlement adjustments could also be put in place.

The “corrected model” and the “regulated model” do exist in some countries and may be implemented further, depending on the national situation and on the type of customers with whom aggregators contract.

It is important to highlight that these three models require the definition of a baseline methodology in order to clearly assess the volume of energy shifted by the consumer and then re-routed and sold on the market by the third party aggregator.

Third party aggregators’ balance responsibility

All players active on the wholesale electricity markets should bear the same responsibilities. Consequently **third party aggregators selling aggregated demand response products on these markets must be balance responsible**: their input should be equal to their output. If a customer reacts only partially to the third party aggregator’s demand response request, then it is **the aggregator who should bear the imbalance cost; it should not create additional imbalance costs for the BRP/supplier**. This point is elaborated in greater detail in Annex 3.

Link 2: Information flow between third party aggregators and BRPs/suppliers on demand response activations

In cases where third party demand response aggregators activate demand response, especially for consumers with online interval metering, BRPs/suppliers may react to the sudden change in consumption by adjusting their injection in order to keep their perimeter in balance. However, to facilitate properly functioning demand response, it is crucial that BRPs/suppliers do *not* adjust their injection in reaction to a third party aggregator’s demand response action. Indeed, such adjustments would offset the aim of demand response, i.e. freeing up electricity to be re-routed and (re)sold on the market.

To ensure that demand response takes place effectively, BRPs/suppliers need information from third party aggregators on customers’ activation[12]. When numerous smaller customers are activated, more aggregated information should be provided to each BRP/supplier whose customers are involved.

This communication allows BRPs/suppliers to differentiate between aggregator-initiated load reductions for which no action is required and load reductions initiated by the customer for which balancing action is necessary. This information is also needed by BRPs/suppliers to distinguish between demand response events and usual consumption changes in order to correctly forecast future portfolio consumption.

Link 3: Between BRP/supplier and customer: addressing the impact on customers’ consumption pattern (rebound effect)

It is necessary to ensure that, on a commercial basis, BRPs/suppliers are able to renegotiate supply contracts to take into account the indirect effects of demand response (e.g. rebound effects that may bring consumers’ load beyond the range forecasted by the BRPs/suppliers as illustrated in Figure 6) and consequent impacts on sourcing costs. This will ensure that customers not participating in demand response do not end up bearing the costs.

For this purpose a follow-up of third party demand response aggregators’ contracts with customers is necessary.

[12] This information can be available the day before, some hours before or very close to the actual activation time, depending on the type of customer and on the market where the aggregated demand response product is being sold.

These adjustments may be handled differently depending on whether customers' consumption is estimated through synthetic load profiles or telemetered. More detailed proposals for the adjustment of supply contract pricing are presented in Annex 4.

<u>Link 4:</u> Between DSO, TSO and aggregator: addressing the impact on network operation

DSOs must be allowed to conduct constraints management if the secure operation of the distribution system is threatened, and they should be allowed to access the relevant data for this purpose. This could take the form of access to information from the demand response bids, including operation schedules (as early as possible and at gate closure time at the latest) and activations located in congested zones, in order to detect network constraints. On the other hand, DSOs should actively communicate on the availability of the network for the activation of decentralised customers.

This could be facilitated with a traffic light system informing about the network availability (green/orange/red states). It would provide the relevant information to market parties as well as transparency on how "available" different customers are to deliver their services to aggregators, taking into account network constraints. Such processes will require more detailed analysis as they are complex to set and implement.

This interaction could also take the form of a vetting system whereby proposed market bids are screened and receive a yes/no from the DSO before the flexibility product is activated and offered to the market. At the same time, DSOs must ensure that the intervention by aggregators does not impact the security of DSO or TSO networks nor create additional costs for other network operators. If that is the case, DSOs should also have access to constraint management procedures in order to tackle constraints in their networks[13]. DSOs should be able to recover the costs associated with implementing constraints management.

The services provided by aggregators and used by TSOs for balancing purposes must be placed in the overall system common merit order and be available to the entire market, thus ensuring a level playing field with the services provided by other market players. When specific resources need to be activated to solve local congestions on the distribution network, DSOs should guarantee a transparent and non-discriminatory selection and activation of the available resources dispatched by the TSO (e.g. through market-based mechanisms etc.).

In an "emergency" situation (red) in the DSO grid, aggregators should no longer be able to offer bids to market parties in the day-ahead and intraday markets and to TSOs in the balancing market.

[13] This could be also done via using bids offered by aggregators (e.g. on a flexibility platform).

5. Conclusions & Recommendations

Demand response will be one of the building blocks of future wholesale and retail markets, offering the opportunity for electricity customers to reap the full benefits of their flexibility potential. The development of innovative demand response services will empower customers, giving them more choice and more control over their electricity consumption. Phasing out regulated retail prices and rolling out smart meters continue to be key prerequisites to advance demand response further.

Suppliers have long been key players in the field of demand-side flexibility. EURELECTRIC believes that they are best positioned to offer the competitive, efficient and simple demand response services that customers need, especially through time-varying supply prices.

The Energy Efficiency Directive requires aggregated demand response to have access to the European electricity markets. Whereas these markets are set to become more integrated, different models for demand side response aggregation exist in Europe.

In order to ensure that customers get the full benefits of demand response aggregation and do not face undue costs, a **robust, transparent and equitable market design** must be in place for demand response aggregation in wholesale and retail markets.[14] This market design should ensure:

- **A level playing field for all actors**: Providers of aggregated demand response should be subject to the same market rules, the same standards of service, and the same participation rules as other market players. The costs created by the additional operational and contractual actions have to be clearly and fairly allocated to the relevant market actors.

- **A market design suitable for all markets**: When the same principles apply to all markets, flexibility providers can better optimize the value of flexibility across timeframes. In this way, flexibility is made available for all electricity markets.

- **Scalability for large-scale implementation**: Existing inefficient processes and inaccurate allocation of costs and benefits should be removed. A good market design should be based on processes that can be automated, contracts that can be standardised and allocations that can be objectified in order to allow for large-scale implementation.

[14] In line with the recently published Task Force Smart Grid Expert Group 3 report on flexibility

Some demand response providers act as third party aggregators, contracting directly with customers for demand response services and selling aggregated demand response on the wholesale electricity market. A lack of clarity on their roles and responsibilities towards other market parties (i.e. customers, BRP/supplier and TSO/DSO) could leave room for free-riding, thereby increasing costs for customers. In the interest of a future-proof demand response environment, EURELECTRIC recommends:

1. Ensuring that the demand response value is market-based in order to avoid any extra costs to the system, customers and other actors.
2. Implementing adequate communication between third party aggregators and BRPs/suppliers to ensure that demand response can take place effectively.
3. Ensuring that BRPs/suppliers are compensated for the energy they inject and that is re-routed by third party aggregators. To this end, third party DR aggregators and suppliers agree on the rules of compensation. Change of market rules and settlement adjustments could also be implemented. In addition, a clear balance responsibility of third party aggregators is needed.
4. Ensuring that, on a commercial basis, BRPs/suppliers are able to renegotiate supply contracts to take into account the indirect effects of demand response (e.g. rebound effects) and consequent impacts on sourcing costs. This will ensure that customers not participating in demand response do not end up bearing the costs.
5. Facilitating demand response aggregation at distribution network level through information exchanges between DSOs, TSOs and aggregators, for example using a system that reflects network availability.

ANNEX 1 - Definitions

Balance Responsible Party (BRP): a market-related entity or its chosen representative responsible for its imbalances. Suppliers and demand response aggregators could also potentially have a BRP role, as could importers, generators or portfolio operators.

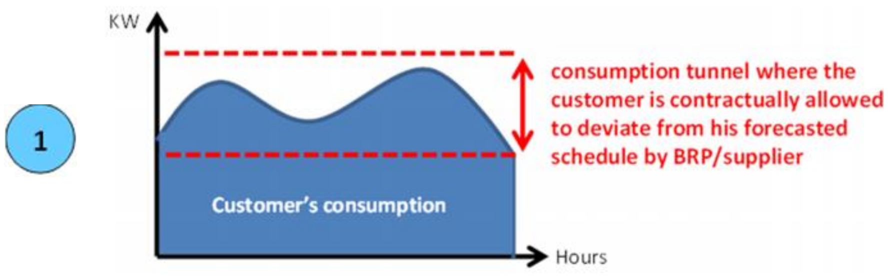
Demand aggregation: a set of demand facilities, which can be operated as a single facility for the purposes of offering one or more demand response services.

Demand response (DR): a series of voluntary and remunerated actions by final customers, either automatic or manual, aimed at changing electricity consumption in response to market signals (e.g. time-varying electricity prices) or by bidding in organised electricity markets directly or through aggregation service providers.

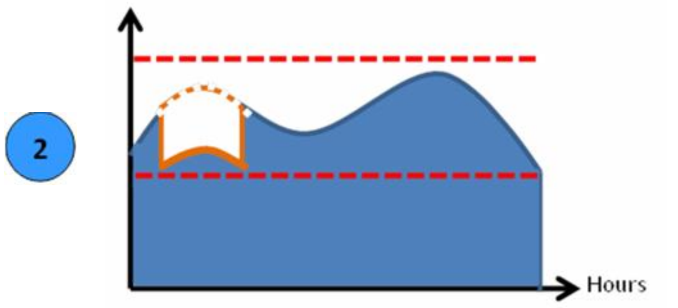
Energy efficiency: a *permanent* consumption reduction while keeping the same level of usage and comfort. By contrast, the primary objective of demand response is to *momentarily* avoid demand or shift demand from *one period to another*, sometimes resulting in an occasional usage loss. Energy savings as a result of demand response programmes depend on the degree to which consumption is deferred. In some cases the totality of the shifted electricity consumption is not consumed later.

Flexibility: any modification of generation injection and/or consumption patterns in reaction to an external signal (price signal or activation) in order to provide a service within the energy system.

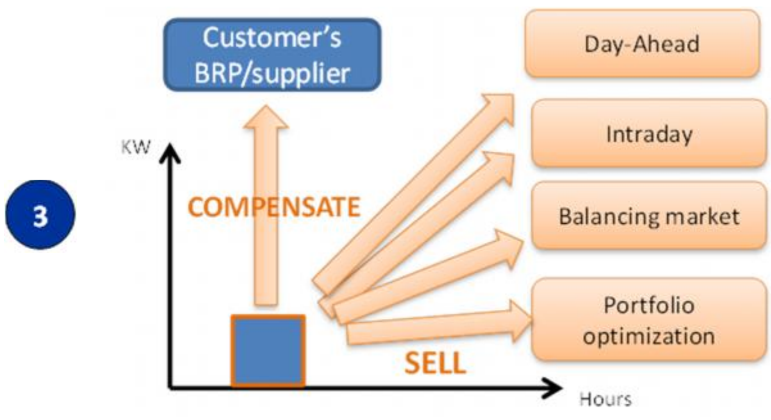
ANNEX 2 - Third party aggregator's actions step by step



The BRP/supplier forecasts its customer's consumption within a certain range (i.e. the tunnel of imbalance the customer is contractually allowed to move within)



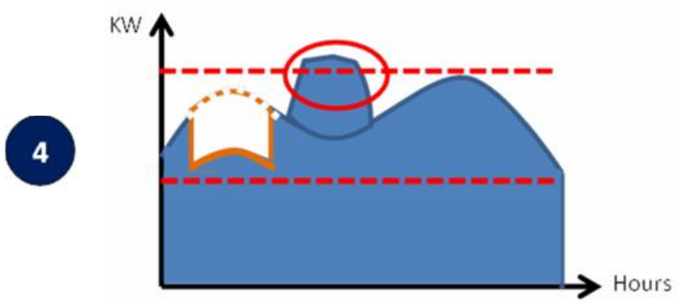
Third party aggregator asks customer to reduce consumption at a certain point in time. BRP/supplier supplies as forecasted but is not paid by his customer for this electricity and may face undue imbalances (**Addressed by Link 1**)



Third party aggregator sells this electricity block and compensates the BRP/supplier for it (**Link 1**)

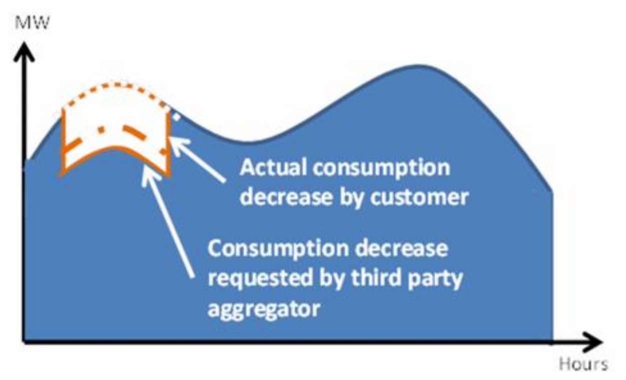
The amount of energy sold on the market should be equal to the amount of energy shifted by the consumer and compensated to the BRP/supplier; otherwise the third party aggregator faces an imbalance.

To define the shifted volume an accurate baseline methodology is needed.



The customer may shift his consumption to compensate for the previous decrease (rebound effect) beyond the range forecasted by the BRP/supplier which may incur extra imbalance costs for the BRP/supplier as he goes beyond the contractual range **(Addressed by Link 3)**

ANNEX 3 – How to handle imbalances created by customers' partial reaction to third party aggregator's demand response requests

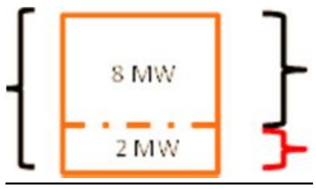


1. Third party aggregator asks customer to reduce consumption by a certain amount, for example by 10 MW;
2. But the customer's actual consumption reduction is only 8MW;
3. As planned, third party aggregator sells these 10 MW to the market;
4. Third party aggregator compensates BRP/supplier for the actual consumption reduction: 8MW;
5. Third party aggregator faces a negative imbalance of 2 MW.

<u>In more detail, the situation is the following</u>:

Demand reduction required by third party aggregator to customer: 10MW

Aggregator sells these 10 MW on the market



Demand reduction actually realized by the customer: 8MW

Negative imbalance of third party aggregator due to partial reaction from the customer: 2MW

<u>In conclusion</u>:

The imbalance created by the partial reaction of customer to third party aggregator's request should be allocated to the third party aggregator who might on his turn have a contractual arrangement with the customer in case he did not comply with the requested load reduction.

ANNEX 4 - LINK 3- between BRP/Supplier and customer: addressing the impact on customers' consumption pattern (rebound effect)

The adjustment of customers' supply contracts is a purely commercial issue which should result of a negotiation between the two parties. It is nonetheless crucial that the necessary information is available so that market actors can negotiate these adjustments. Obviously these adjustments can be done in a more detailed way when consumers are equipped with smart meters.

EURELECTRIC has identified several options to implement adjustments to the pricing of supply contracts:

a. *Pre-emptive adjustment* is the standard inclusion of load changed and energy volume risks linked to demand response aggregation in all or some contracts. If done correctly, it can fully compensate for changes in the consumption pattern of customers. However, it does risk to price the BRP/supplier out of the market by pre-emptively including this risk into the price or to cause an increase of all retail prices.

b. *Conditional adjustment* of consumption pricing means that the contract is renegotiated with regard to changes in the consumption pattern in case the customer contracts with a third party aggregator. In should be made possible to enforce the clauses of renegotiation that are currently already in contracts in case of substantial changes in consumption, but difficult to enforce.

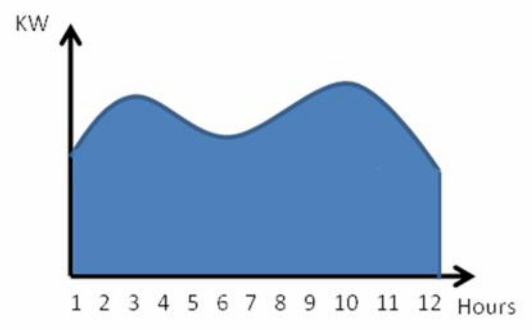
c. *Reactive adjustment* reviews customer consumption patterns in fixed intervals. If the customer has contracted with a third party aggregator during the previous interval, his flexibility conditions are renegotiated. This option poses financial risks for the BRP/supplier by allowing for periods during which the customer load profile is mispriced.

Option b) (conditional adjustment) seems to be the most desirable solution, provided that suppliers are able to incentivize customers to inform them about contracts signed with third party aggregators. For residential customers option a) (pre-emptive adjustment) would be the most feasible.

ANNEX 5 – Synthetic load profile Vs actual consumption data and consequences for demand response aggregation

Retail markets are at different stages in Europe, especially regarding metering and consumption forecasts methodologies.

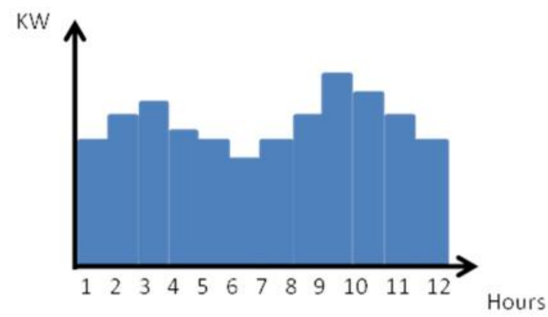
Standardized Load Profile (SLP)



For customers with traditional meters, the BRP/supplier estimates the shape of the consumption curve by developing synthetic load profiles. This methodology is still in use in the majority of European retail markets.

Implications for demand response aggregation: SLPs are statistically representative for a customer segment. If there is a strong impact of third party aggregators on customers' consumption patterns, SLPs will be less accurate and representative. Furthermore, the use of SLPs makes it more difficult to calculate a baseline, to allocate imbalances and to assess rebound effects. As a result, complex estimation methodologies and arrangements must be put in place.

Actual consumption data



For customers equipped with a smart meter, the BRP/supplier can access the actual consumption data on a more frequent basis and therefore elaborates a more accurate consumption forecast.

For large customers actual consumption is already available to the BRP/supplier through specific metering devices. Some larger customers even make a forecast of their off take which defines the starting point of all deviations; all of this is part of contracts between customers and their BRP/supplier.

For smaller customers, smart meters are already rolled-out in several European countries and large scale roll-out is planned for 2020 in most EU countries.

Implications for demand response aggregation: Actual consumption data allows a more accurate follow-up of customers' demand response actions and facilitates the baseline calculation. Measurement and verifications as well as the imbalance allocation are easier to implement.

EURELECTRIC pursues in all its activities the application of the following sustainable development values:

Economic Development

- Growth, added-value, efficiency

Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability

[redacted]

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