May, 2020

Public Consultation on Demand Response Independent Aggregator Framework

Voltalis wishes to thank the Finnish regulator for this consultation. In its following contribution, Voltalis underlines key elements of the Demand Response (DR) market design recommended by "Clean Energy Package" EU Directive 2019/944 from June 5th, 2019 (the Directive), backed by its extensive experience as DR Independent Aggregator (DR-IA) in France and several other countries in Europe and abroad.

Directive Guidelines

Key principles

Thanks to many implementations in different countries, DR is now fully ready to be integrated to markets: reliable SCADAs allow real-time monitoring and control, and aggregators can take commitments on markets, and bear responsibility for their imbalances. As a cheap alternative to fossil-fuel generation, and a very effective way to balance the intermittency of distributed and renewable generation, DR has a deployment potential of up to 160 GW (as quantified by the European Commission), to serve balancing and grid management objectives, while abiding by climate-friendly regulation set by the EU.

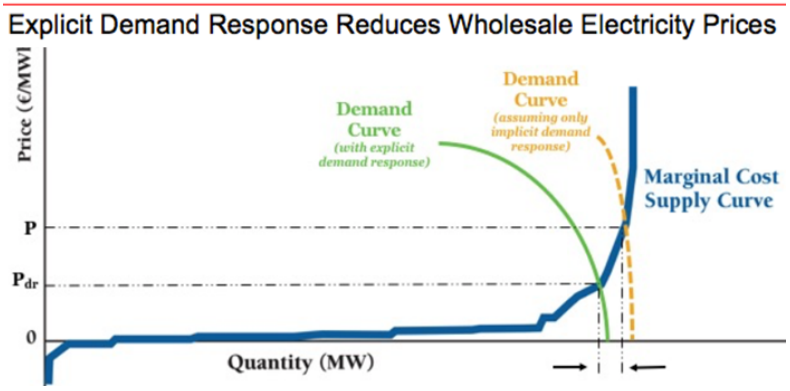
The Directive encourages member states to foster DR development by implementing a non-discriminating regulatory framework. Such a framework will rely on the following principles:

- responsibility of the DR-IA with respect to its market commitments;
- nor prior consent to DR from consumer third-parties, in particular its supplier;
- convenient access to consumer data, yet ensuring appropriate protection;
- access to all markets.

A compensation scheme may be implemented, at each state initiative, to the benefit of the suppliers impacted by DR. Such a scheme would be designed to take into account those suppliers' possible costs (reduction of sold volume, due to DR), but should be carefully calibrated to avoid over-compensation or creating undue entry barriers for DR. **Proper sharing of compensation costs is pivotal here**, and should be carefully defined to comply with the principles set in the Directive.

Economics

DR is offered alongside generation assets, and is selected only if cheaper, hence driving clearing price down for all market participants, as shown below[1] - while also reducing CO_2 emissions.



Direct benefits for all consumers result from difference of price achieved in the market with versus without DR bids and can be verified by computing counterfactual price. Following table[2] presents benefits computed on several EU markets, over three winters:

	Market	Year	Average decrease in spot price on application of DR (€/MWh)	Whole market retailer benefit [M€]	Compensation payment to retailers (based on French compensation model) [M€]	DR sales [M€]	Retailer market benefit/ (Cost = DR sales)
400h/1 GW	FRA	2013/14	13.01	379.27	28.06	24.68	15.37
		2014/15	11.81	344.57	27.93	20.77	16.59
		2015/16	18.99	515.54	21.42	15.72	32.80
	GER-AUT	2013/14	20	635.83	24.44	19.13	33.24
		2014/15	13.83	458.89	22.66	17.9	25.64
		2015/16	11.29	355.13	18.4	15.58	22.79
	NORDIC	2013/14	7.71	186.32	19.69	14.26	13.07
		2014/15	5.49	135.12	18.08	13.47	10.03
		2015/16	10.21	272.75	14.75	13.98	19.51

DR participation implies a loss of opportunity for suppliers involved in DR, which sold volume is reduced. This cost is however expected to be much lower than benefits, by a factor of 10 to 80 in the above simulations: in a nutshell, a DR activated volume of 400 GWh on a given market is expected to bring a 1.6 G€ net benefit per year to all electricity suppliers and thus to all consumers.

Compensation schemes, whatever the model chosen, rely on a financial settlement from the Transport System Operator (TSO), responsible for implementing and supervising market operations, to the supplier: the question is then to define how the TSO recovers its cost from market stakeholders. The Directive allows each state to design its own framework, provided it does not create undue entry barriers for DR, hence that any compensation be shared among all parties, and not uniquely borne by DR-IA; as an example, France DR market framework

[1] Source: report by The Regulatory Assistance Project.
[2] Source: report by The Regulatory Assistance Project.

has demonstrated[3] that compensation fully charged to DR-IAs deprive DR of market revenues, hence forbids DR development. An appropriate design should rely on the net benefit principle, to be implemented as follows:

- TSO compensation costs to DR-impacted suppliers should be shared among all suppliers, impacted or not by DR, based on their market share;
- in the event of a DR activation not benefitting suppliers more than the said costs, DR-IAs contribute in order to offset the remaining net costs for DR-impacted suppliers (i.e. only the difference between cost and benefits);
- suppliers net benefit monitored on a regular basis (e.g., monthly or yearly).

This proposal, by ensuring that suppliers all benefit from DR activation, and that DR-IAs are only charged when degrading overall benefits for all suppliers (and thus ultimately for all consumers), should be strongly supported by all market stakeholders, and will create relevant conditions to foster suppliers' involvement in DR, hence the DR development targeted by the Directive.

Implementation

DR development first relies on DR-IAs reliability, hence on performance control, which raises the challenge to compute activated energy volumes, while DR volume is, by definition, non-measurable. In practice, DR volumes are computed by comparison between the actually measured load curve and the modelled counterfactual baseline. An efficient volume determination process must rely on:

- optimized metering: sub-metering, fast data collection rate, powerful aggregation algorithms;
- accurate baseline computation algorithms, several of which are already operational in various European markets;
- day-to-day computations performed by DR-IAs to relieve TSOs from IT burden, especially in a fast-moving context: data are made available close to real-time and subject to TSO audit.

Personal data are protected by GDPR framework, and made available at an aggregated level as generally as possible. Data transmission is limited to TSO settlement[4] to prevent from anti-competitive provisions.

DR-IAs should be treated as generation assets operators, hence should bear balance responsibility, but limited to their DR operations, *i.e.* not consumer supply. DR activated volumes computed from the baseline are allocated to DR-IAs balance perimeter as “injections”, sales as “offtakes”. Some markets may not require balance responsibility, such as balancing services.

[3] 10 years of DR market access in France: 23 DR-IAs, but only 27 GWh activated, and 2 GW of installed capacity.
[4] Possibly, DSO settlement, if DSO markets do emerge.

Comments on the options set forward in the consultation document and responses to specific questions

Supplier compensation

Which benefits could the aggregator bring to third parties that should be taken into account when determining financial compensation?

The approach proposed in the consultation document is to implement a scheme to explicitly compensate suppliers involved in DR activations for any loss of opportunities they may incur. While the rationale for this compensation is considered in the European Directive, as it states,, it would be unfair to ignore benefits captured by suppliers, thanks to DR activations, namely a significant reduction of sourcing costs.

The obsolete notion of transfer of energy ownership

First, it is essential to clarify that DR valorizes an avoided consumption; it does not rely on generation being injected in the grid, but provides an alternative to generation. Therefore, a DR-IA cannot be considered as a usual energy trader, buying energy (acquiring ownership) on the one hand, and selling it at a different price on the other hand. Ownership considerations on energy that does not exist intended to try to justify a compensation to suppliers are a legacy of obsolete DR frameworks, and are now excluded by the Directive, which refers to specific costs they may incur, not to any transfer of energy that does not exist.

Perimeters correction

It is to be noted that DR will usually be activated when the electric system is “short”, and prices are high. If BRP perimeters are not corrected, the activated BRP is automatically compensated for its loss of opportunity by the imbalance settlement process, at a greater price than he would have expected. No compensation is justified in this case, as stated by the article 17-4 of the Directive, strictly limiting compensation to situations where BRP face an extra cost due to DR activation.

If perimeters are corrected, the BRP is deprived from this revenue, and could be compensated by the TSO, which would in turn recover its cost from market parties. The Directive does not state that this compensation should be paid by DR-IAs only; on the contrary, it forbids any compensation scheme to create market entry barriers for DR, hence requires sharing the burden: how to share this compensation among stakeholders is detailed below.

Net benefit

Financial settlement from the Balance Responsible Parties (BRPs) community point of view must be appreciated as the net benefit defined by the Directive, *i.e.* the loss of opportunity to sell DR volumes on the one hand, but also the cost reduction on all sold volumes on the other hand. Net benefit computation is already operational on a day-to-day basis[5], hence designing a market around it is not a challenge. But even without computing benefits, suppliers capture them, because they pay the market price for their purchases, i.e. a lower price thanks to DR participating in the market.

Then if the net benefit is positive, in favor of the BRPs community, no compensation from DR-IAs should be considered, and the BRPs community should (via the TSO payment)

[5] For instance, in several US markets (see CAISO or PJM’s net benefits test for instance)

compensate for its members which have been negatively affected by the DR events benefitting the whole.

Conversely, should the net benefit be negative, a compensation payment from the activated DR-IAs can indeed be derived, but limited to the losses of the BRPs community; more specifically, the DR-IAs compensation must be designed to bring the BRPs net benefit back to zero, not generate windfall profits for them.

Ignoring benefits induced by DR and setting compensation level inappropriately would impede any significant development of DR assets in Finland. Such a dramatic outcome, considering the extensive regulatory effort already carried out both at European and Finnish level, cannot be an option an option.

The French experience is very illustrative in this regard:

- for several years, no benefits were taken into account, only suppliers' loss of opportunity;
- compensation is due in full by DR-IAs, and indexed on market prices, which is equivalent to arbitrarily forcing a market-based cost to zero-marginal-cost assets, which are supposed to capture their revenue from… the market!
- No significant revenue can derive from such a framework, and DR capacity has been frozen for several years, at less than a third of capacity levels targeted by public policy goals;
- as a consequence, French regulatory framework is moving on, and sharing the compensation payment is now scheduled to be borne by the suppliers' community, so as to remove this barrier which was blocking actual market participation of DR.

Conclusion

To sum up, compensation scheme should be implemented according to the Directive guidelines, hence:

- net benefit computation is integrated in the market operational process;
- if net benefit is positive for the BRPs community, they compensate negatively-impacted BRPs for their 'cost' (loss of opportunity):
    - a possible implementation involves a compensation at SPOT market price, each BRP contributing to the extent of its market share;
- if net benefit is negative, DR-IAs contribute as a whole to compensate for the negative benefit, each DR-IA to the extent of its activated volume.

How should "low energy" be defined, ie how should products for which financial compensation is not required be defined?

Voltalis is strongly in favor of the simplification principle suggested by the regulator. The effort of implementing any compensation framework is not justified below an aggregated DR activated volume of 500 to 750 MWh on a given hour[6]. In other words, DR markets should be launched without any compensation scheme, hence allowing sufficient time for capacities to be installed and activated, and for real issues to emerge if any, and possibly lead to future work on compensation.

[6] Finnish winter peak load is approximately 15 GW; 1% of this power activated for one hour gives 150 MWh.

Technical provisions

DR reliability is an absolute necessity to promote its development: lack of performance will constrain regulatory evolutions and mitigate investors' appetite; and reliability is largely dependent on efficient control methods, hence on accurate baseline computation methodologies.

Can a meter measuring the total consumption of a site provide sufficiently accurate information to separate the actual flexibility from the consumption of the entire site?

This accuracy first relies on the accuracy of the underlying data. Consequently, DR-IAs should be allowed to access the most precise measurement of their activity, namely their consumers' load curves. Precision requirements will depend on targeted markets as well as DR-IA processes, and therefore should be left to the DR-IAs' responsibility. Of course, standard TSO/DSO metering should be made available to aggregators, but it is deemed to embed the following limitations:

- TSO/DSO load measurement infrastructures (even smart meters and the related IT and transmission systems) are usually not designed for real-time data collection, much less for real-time data transmission to DR-IAs;
- TSO/DSO metering is usually performed at site level, hence significantly degrading assessment of flexible loads, specifically targeted by DR;
- TSO/DSO metering is designed for imbalance settlement, and is usually limited to sampling periods of several minutes, at best; it does not meet the requirements of the most critical markets[7], hence forbidding their access for DR.

Who would own the extra meter? What challenges do you see regarding meter ownership?

DR-IAs should then be allowed to deploy their own load measurement infrastructure, at their own cost.

What possible challenges do you see in the measurement based on an additional meter, incl. meter requirements and verification of measurement data and data transmission to the balance sheet?

Their data will preferably be used for financial settlement of their market activity, provided that it regularly passes quality examination by the TSO/DSO[8].

What is your view on the baseline method as part of the flexibility measurement? How should the baseline curve describing assumed and unrealized energy consumption be determined?

Baseline computation methodologies are miscellaneous and must be adapted to the DR process to be evaluated. For instance, much literature already exists on "historic" baselines[9], aggregated from DR-free load curves, and measured in the recent past of a DR event. Those methods, however, rely by definition on large DR-free periods, and are then not suited to regularly activated DR processes, such as residential DR. In this case, a real-time individually determined baseline has proved reliable. Voltalis suggests close collaboration between TSO and DR-IAs to take into account their specificities, and to implement the most appropriate

[7] Such as frequency regulation, usually requiring data collection on a few seconds basis.
[8] Or a qualified third-party, mandated by TSO/DSO. Such a qualification protocol has been operational in France, supervised by RTE, since 2015, where data quality is audited every 3 years.
[9] For instance, the baseline method used in Fingrid mFRR pilot project conducted from 2017 to 2019 with Voltalis, is defined in *Distributed generation & demand side response services for smart distribution networks*, Report A7 from Low Carbon London Learning Lab, Imperial College, London, United Kingdom, September 2014.

baseline methods; inspiration from already operational markets, and “sand-boxing” will indeed be efficient approaches.

As an example of such a technical collaboration to derive an appropriate baseline computation methodology, RTE[10] and Voltalis have designed the “real-time individually determined baseline”[11], which principles are laid out below, and could be easily implemented in Finland and other countries:

- the method relies on DR patterns typical to residential appliances, *i.e.*, short and regular consumption sheddings, spread over thousands of sites involved in turn to ensure comfort;
- a baseline is computed at site level: DR events are identified[12] and counterfactual consumption is assessed as the average consumption immediately before the event: such a model does work at site level where elementary sheddings are short. In the figure below, a typical residential site load curve over 24 hours is shown in blue, sheddings are visible in white (as absence of blue), and the computed baseline is displayed in red;
- baselines are summed over all sites involved on the DR-IA activation perimeter, and result in a precise counterfactual load curve for the aggregate, able to capture consumption natural variations, as illustrated below.

Illustration of the real-time individually determined baseline
used for widespread DR involving short curtailments of numerous consumers' loads

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[10] French TSO.
[11] In French market rules, « Rectangle Algébrique Site à site » (RAS).
[12] Ideally, from DR-IA information system.