Article 17 of the recast Internal Market Directive and the benefits of aggregated demand response

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October 2018

Aggregated or "explicit" demand response, where customers allow their demand to be "flexed" (that is, managed by a third party in return for some financial incentive) and sold into the wholesale market in competition with offers from generators, will provide an opportunity for those customers to collectively participate in wholesale electricity markets and profit from their demand flexibility without having to incur the risks and costs of managing direct exposure to real-time energy prices. This will reduce market clearing prices and thereby reduce the costs incurred by suppliers when purchasing energy for their customers. The reduction in costs could be considerable: for example, it is estimated that 1 gigawatt of demand reduction across the 50 hours of highest demand in the French day-ahead market during 2015–2016 would have reduced energy costs by 22.5 million euros.[1] Furthermore, as day-ahead prices impact the price of energy traded in all other timescales, the "whole-market" savings could have been as high as 122 million euros over those 50 hours.

Savings of this order are clearly worth pursuing. However, there are many barriers to the development of aggregation.[2] In some Member States, demand response is not allowed to participate in all market timeframes or is given only restricted access to those markets. In others, independent aggregation is not permitted at all; market access is restricted to only the largest industrial customers. Another significant barrier is the requirement in many Member States that aggregators first obtain a supplier's permission before operating on a customer's demand and then compensate the supplier for energy not used as a consequence of providing the explicit demand response—that is, compensation for energy that cannot generally be billed. Given that most European markets do not allow energy prices to reflect real value when resources are scarce, compensation can consume most or all of the revenues currently available to aggregators, seriously undermining the economics of explicit demand response and putting at risk the associated potential benefits to customers.

The European Commission clearly recognises the potential benefits of aggregation and the need to address barriers to its deployment. In Article 17 of

[1] The Regulatory Assistance Project. (2017, October). *Benefiting Customers While Compensating Suppliers: Getting Supplier Compensation Right*. Available at https://www.raponline.org/knowledge-center/benefiting-customers-while-compensating-suppliers-getting-supplier-compensation-right/

[2] Smart Energy Demand Coalition. (2017, March). *Explicit Demand Response in Europe: Mapping the Markets in 2017*. Available at https://www.smarten.eu/wp-content/uploads/2017/04/SEDC-Explicit-Demand-Response-in-Europe-Mapping-the-Markets-2017.pdf

the recast Directive on the Internal Electricity Market, the Commission proposed, inter alia, that aggregated explicit demand response be given full non-discriminatory access to all markets and effectively be treated as if it were generation. Significantly, the Commission also proposed that, although suppliers should be compensated for any imbalances caused by explicit demand response, aggregators should no longer be required to compensate suppliers for energy not consumed by customers when providing that demand response. However, counter proposals by both the European Parliament and Council have resulted in compromise text that would require suppliers to be compensated by "undertakings including independent aggregators" while suggesting that any compensation may take into account the benefits of aggregation seen by other market participants.

Making sense of the Article 17 proposals

Three themes emerge from the Article 17 proposals. First, aggregation should not impose imbalance costs on a supplier or its balancing service provider, or at least that those costs should be fully compensated. Second, although the compromise Article 17 text is not entirely clear on this point, it appears to require that compensation should be extended to include energy purchased by suppliers but not consumed due to explicit demand response organised by an aggregator. Third, compensation requirements may take into account the benefits of aggregation and should not represent a barrier to entry; in other words, compensation arrangements should not unduly undermine the economics of aggregation.

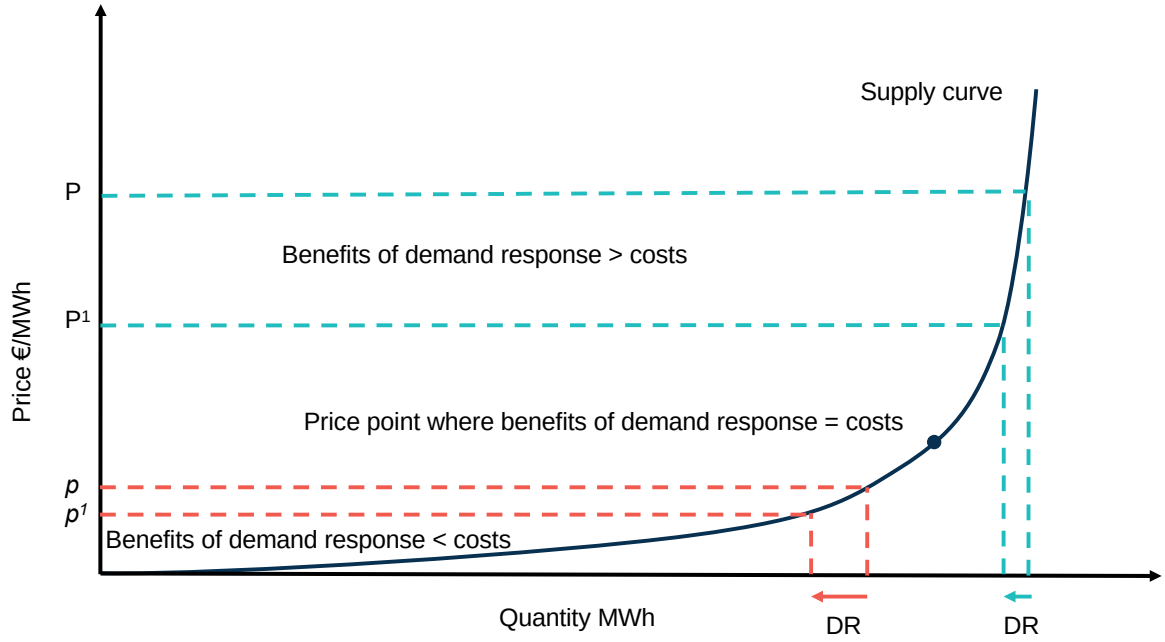
The first of these themes is clearly appropriate and is covered by Article 4 of the recast Regulation (Regulation of the European Parliament and of the Council on the Internal Market for Electricity – recast) and Article 17 of the Directive, which both require that aggregators be financially responsible for any imbalances they cause. The second also seems appropriate insofar as aggregated or explicit demand response would not be possible unless suppliers continued to purchase energy in anticipation of their customers' full demand. The third theme, that any compensation arrangements should not undermine the business case for aggregation, also seems appropriate in light of the benefits that aggregated explicit demand response can bring. However, the suggestion that the negative impacts of direct aggregator-to-supplier compensation can be offset by taking account of the benefits of aggregation, while well intentioned, will likely be difficult to implement in practice.

The benefits of aggregation

Although the benefits of aggregation can be simply defined, calculating them in real-world market processes could raise significant challenges. As illustrated in Figure 1, the net benefit of aggregated demand response in a particular trading period is defined by the difference between the clearing price with demand response and the price without demand response ($P - P^1$), multiplied by the

energy traded in that period, minus the cost of the accepted demand response bids (P^1 * DR).

Figure 1. Benefits of aggregation



Calculating those benefits in real time would require a rerun of the day-ahead market auction to determine the clearing price in the absence of any demand response bids. Although this is theoretically feasible (and indeed it has been an established feature of the day-ahead market in Singapore since 2015[3]), it may not be a practical option in the European market. Integrating a "counterfactual" no-demand-response auction into the day-ahead market processes operated by individual power exchanges may involve unacceptable complications, and it is also difficult to see how it could be incorporated into the intra-day continuous trading process.

Two possible models

We are not dismissing out of hand the possibility that the benefits of aggregated demand response can be calculated within the operations of the European day-ahead and intra-day markets. However, given the difficulties of doing so, other simpler options of meeting the supplier compensation requirements of the amended Article 17 ought to be considered. Two approaches in particular seem worthy of examination.

[3] Energy Market Authority. (2013, October). *Implementing Demand Response in the National Electricity Market of Singapore: Final Determination Paper*. Available at https://www.ema.gov.sg/cmsmedia/Electricity/Demand_Response/Final_Determination_Demand_Response_28_Oct_2013_Final.pdf

The "self-compensation" model

This option would effectively require suppliers to "self-compensate" for the loss of revenue associated with reduced consumption caused by aggregated demand response, by withholding some of the benefits of aggregation from their customers. All suppliers benefit from explicit demand response. The benefit comes in the form of reduced energy purchase costs, which presumably they pass on in some form to their consumers. Although "self-compensation" would result in a slight reduction in the benefits seen by consumers, it seems appropriate that, as the ultimate beneficiaries, *all* customers should shoulder the costs of delivering those benefits. Self-compensation avoids the need for direct aggregator-to-supplier compensation (unless the benefits of aggregation fell negative; see below) and is consistent with the spirit of the compromise Article 17 amendments, that is, that compensation may take into account the benefits of aggregation seen by other market participants.

Even so, as noted earlier, such an arrangement would require a test to be performed to ensure that the benefits of aggregated demand response that accrue to suppliers are positive. Indeed, we expect that they will almost invariably be positive, but there can be circumstances in which they are not. They could fall negative, for example, if more demand response is acquired than is economically justified or it occurs at the wrong point on the supply curve (see Figure 1). In this case, the cost of demand response P^1 * DR would be greater than P – P^1 * energy traded. In this situation, it is arguably appropriate for aggregators to compensate suppliers directly for any energy purchased but not consumed due to aggregation, as suppliers would no longer be able to "self-compensate." This could be handled through a formal aggregator-to-supplier compensation scheme, most likely administered by the transmission system operator (TSO) and only activated when benefits fall negative, or through bilateral arrangements between individual suppliers and aggregators. Whichever option is preferred, requiring aggregators to compensate suppliers directly when the net benefits of aggregation turned negative would provide a strong incentive to ensure that demand response was not over-deployed or acquired at an inappropriate time.

It is worth noting that a test to determine the point at which the benefits of aggregation turn from positive to negative—that is, the "net benefits test"—has been used by independent system operators and regional transmission organisations in the United States for many years. The test, the requirements of which are set out in the Federal Energy Regulatory Commission Order 745,[4] is applied "offline" on a monthly basis using updated historic data, thereby avoiding the complications of incorporating the process into online market systems. As applied in the United States, the test establishes the price point on the supply curve at which the benefits of aggregation are equal to the costs. When prices rise above this price-point, explicit demand response is paid at the market clearing price. When prices fall below the price-point, aggregated demand response

[4] U.S. Federal Energy Regulatory Commission. (2013, March). Docket No RM10-000; Order No 745. Demand Response Compensation in Organized Energy Markets. Available at https://www.ferc.gov/EventCalendar/Files/20110315105757-RM10-17-000.pdf

receives no remuneration from the market. No compensation arrangements are in place to cover the costs of explicit demand response.

The compensation model

The self-compensation method appears to be the simplest method of complying with the requirements of the Article 17 amendments, but it does suffer from the drawback that it allows some suppliers to profit from explicit demand response more than others. Although all suppliers will see the benefits of reduced market clearing prices, those suppliers whose customers engage in explicit demand response will also see costs, that is, the costs of purchasing energy that is not consumed and therefore that cannot be billed. This may not be a significant issue once explicit demand response and aggregation have become widespread, but it might be a problem in the early stages of deployment.

One solution would be to introduce a supplier compensation scheme funded by a charge on suppliers and other demand takers. This would comply with the wording of the compromise Article 17 text, which requires that suppliers be compensated by "undertakings including independent aggregators." Although suppliers compensating suppliers may seem a rather circular arrangement, it would be justified in that suppliers benefiting most from aggregation would compensate those suppliers exposed to the costs of providing the benefits. As in the previous model, compensation would be provided by aggregators in those situations where the net benefits of aggregation turned negative.

The concept of a compensation scheme funded by a charge on suppliers and other demand takers is already established. The Singaporean model includes a compensation scheme wherein suppliers are compensated by the TSO, the costs of which are funded by a charge on all suppliers and other demand takers. It is also worth noting that, once the French 2015 Energy Transition Law is fully enacted, a similar arrangement may operate in France as well. Although the details are not yet fully resolved, the proposal calls for some part of the supplier compensation to be paid via the TSO, funded by a charge on all suppliers.

Summary

Explicit or aggregated demand response provides an opportunity for domestic and smaller-volume consumers to participate in the electricity markets without the risks presented by dynamic tariffs. In doing so, these flexible consumers can significantly reduce the price of energy purchased by suppliers by offering a competitive alternative to more costly generation, thereby creating benefits for *all* consumers. However, there are significant barriers to the development of aggregated demand response. Not least of these is the requirement in some Member States for aggregators to directly compensate suppliers for energy not consumed, a requirement that could stifle the development of aggregation and prevent consumers from enjoying the benefits of reduced energy prices.

We identify two alternatives to avoid this outcome. Both comply with the amended text of Article 17 and both result in suppliers being compensated for energy bought in anticipation of consumer demand but not actually consumed.

As can be seen in Table 1, both are similar in nature. The "self-compensation" model has the advantage of simplicity but could result in some suppliers benefiting more from aggregation than others. The "compensation" model has the added complication of a formal supplier compensation scheme but has the advantage of equitably compensating those suppliers that would otherwise benefit least from aggregation. The self-compensation model may be more applicable in the early stages of aggregated explicit demand deployment; however, once aggregation becomes an established and widespread market feature, the problem it addresses should subside and the additional complication of a supplier compensation scheme funded by a charge on all demand may no longer be justified.

Table 1. Self-compensation versus supplier compensation

	Model Design	Pros	Cons
Self-compensation	• Suppliers self-compensate using benefits of aggregation • Offline "net benefits test" • Aggregators compensate suppliers when net benefits of aggregation are negative	Simple No general compensation scheme required	Some suppliers gain more than others, at least during early deployment
Supplier compensation	• Supplier's compensation funded by a charge on demand • Offline "net benefits test" • Aggregators compensate suppliers when net benefits of aggregation are negative	Suppliers share benefits and costs equally	General compensation scheme required

Both models rely on a "net benefits" test, which, as in the United States, can be applied "offline" to avoid the complications of building counter-factual assessments into market processes. The test would establish the price-point below which the net benefits of explicit demand response became negative. Both models envisage aggregators compensating suppliers if market prices fall below this price point.