ENERGY FLEXIBILITY: THE DEVIL IS IN THE DETAIL

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The need for greater flexibility to balance demand and response in our power systems is now widely accepted. As is the need for flexibility aggregators – new players in the energy value chain who can enable feasible flexibility trading for effective demand-side response. In general terms, aggregators bundle together the small packets of flexibility offered by prosumers into volumes that are useful for balancing the grid. But exactly how should they do that? And how should the flexibility market in general operate?

This is the challenge facing industry players and regulators across Europe. And it is vitally important that they come up with the right answer. Proper implementation of the aggregator function is essential to give prosumers – individuals and organisations who both produce and consume electricity – easy access to an otherwise complex market. Without that access, there is no hope of implementing effective demand-side response and grid balancing in tomorrow's more dynamic and renewable-friendly power systems. As a result, energy prices will rise considerably and the system could become vulnerable to instabilities that ultimately lead to power outages.

> "Aggregators will become the key turning point for facilitating market transaction of Demand Response. Supply security should not be overlooked in the eagerness of spurring energy markets as the solution to future balancing of the grid."
> - Poul Brath, DONG Energy -

These are highly complex questions. There are many different parties involved across the value chain, and all their interests and needs must be taken into consideration. Furthermore, each country or region has a different starting point in terms of existing market order and traditional roles of energy players. It has become clear over recent years that there is no one solution that could deliver optimal results in all markets. However, there is a strong drive to harmonise Europe's energy markets. Thus, it is highly desirable that regulations and operating practices in all EU countries are broadly aligned.

> "I believe the recommendations and considerations from this work will act as a guide for all European countries for years to come."
> - Ulrik Stougaard Kiil, Energinet.dk -

Optimisation and harmonisation

Building on the sterling work of many other bodies, the Universal Smart Energy Foundation has been exploring how to balance all these competing considerations through its Aggregator Workstream. The Workstream comprises an international team of experts from organisations throughout the energy value chain, bringing a unique collection of perspectives to bear on this vital challenge by taking a deeper, engineering view of the various challenges involved in implementing demand-side response, it has been able to go much further than ever before in outlining an effective approach for designing energy flexibility markets. In particular, the Workstream has developed a series of possible models for implementing the aggregator function within different markets. These models offer the freedom to optimise implementation for the individual conditions of a specific market, while providing the basic alignment needed for harmonisation.

"The full implementation of a new customer-centric model requires an evolution of the current market design."
- Andrea Galieti, ENGIE -

A deeper look

In an area as complex as this, all high-level choices raise issues and challenges further down the line during implementation. Understanding these issues and their potential consequences is essential in order to choose the right option for the given market. To aid decision makers in these choices, the Workstream went beyond simply defining models and developed best practices, recommendations, and considerations for addressing the issues they raise.

"We need to speed up change. This bottom-up work complements the top-down approach of other forums."
- Pieter-Jan Mermans, REstore -

Check your baseline

For example, baselining is the practice of approximating what the energy use and production would have been if no demand-side response event had been triggered. The baseline is the basis for both the transfer of energy between players in the value chain and assessment of the flexibility service provider's performance. Hence it must be fair, accurate and impervious to gaming.

While some aspects of baseline design and calculation are quite general, others are intimately linked to the type of flexibility product chosen. Consequently, the Workstream has developed specific recommendations on who should be responsible for defining baselines and how that should be done for a wide range of flexibility products.

"It is very important to have a good overview of the models, as well as a comparison where all the details are highlighted and elaborated."
- Klaas Hommes, TenneT TSO BV -

"The USEF Aggregator Workstream gives highly relevant policy recommendations and shows which models allow for independent aggregation and which don't"
- Andreas Flamm, EnerNOC -

Expect the unexpected

The Workstream's efforts have also shown that looking deeper at the details of aggregation and demand-side response can unearth unexpected situations that, if not addressed in the market design stage, could cause major problems during implementation. An example of this is the interaction between implicit and explicit demand-side response: implicit demand-side response is based on time-varying electricity prices, while explicit demand-side response gives users upfront incentives in return for agreeing to change consumption on request.

An individual flexibility resource could be subject to both. But detailed analysis of how they interact has shown that certain forms of the two approaches simply cannot be combined. In particular, within certain aggregator implementation models, flexibility services such as day-ahead trading are incompatible with time-of-use contracts.

"The different views from different countries help to develop a European position."
- Claus Fest, innogy SE -

Guiding choices

While the Workstream's in-depth study has led to numerous recommendations to help market architects implement the optimal solution for their specific circumstances, there are also many situations where there is no "best" choice. Rather there are different options that could work well. However, decision makers still need to be fully aware of the technical implications of the various choices and the further issues that would need to be considered to implement their choice properly.

One such situation is the choice between independent aggregator models – where the aggregator isn't contracted to a supply-side balance responsible party (BRPsup) – and so-called contractual models. Both have their strengths and weaknesses. Independent

aggregator models make it easier for new players to enter the market, while contracted models require less regulation as the details of the interaction between aggregators and other players are negotiated by the organisations themselves.

However, the choice between them has profound implications related to the so-called rebound effect. This is the phenomenon where a demand-side response event to reduce consumption can lead to demand being shifted to a later time. The question is: should the aggregator be responsible for this, or is it just treated like any other deviation from the forecast energy profile? Detailed consideration of these issues is essential to ensure a level playing field within independent aggregator models.

> "Contribute to more harmonisation of (local) flexibility markets in the EU."
> - Paul de Wit, Alliander -

Forewarned is forearmed

When developing energy flexibility markets and demand-side response, it is clear that high-level decisions have a major impact on the technical details of the subsequent implementation. Thus, those making decisions must consider these implications to make the right choices.

By exploring this detail and drawing on the diverse expertise of its international team spanning the value chain, the USEF Aggregator Workstream has identified a comprehensive set of concrete recommendations and considerations for further consideration in designing demand-side response markets. This provides valuable input for decision makers, and goes further than ever before in helping them develop optimal energy flexibility policies that enable harmonisation across Europe.

The USEF Aggregator Workstream consists of:

Aggregator:	Andreas Flamm (EnerNOC) Peter Schell (REstore)
TSO:	Ulrik Stougaard Kiil (energinet.dk) Klaas Hommes (TenneT)
BRP:	Valentijn Demeyer (Engie)
Supplier:	Claus Fest (RWE)
DSO:	Paul de Wit (Alliander) Poul Brath (Dong Energy)
USEF:	Hans de Heer (DNV GL) Marten van der Laan (ICT)

USEF is the Universal Smart Energy Framework. It is developed, maintained and audited by The USEF Foundation. Active across the smart energy chain, USEF partners are working together to deliver the foundations of an integrated system that benefits all players – new and traditional energy companies and consumers.

The full report "Recommended practices for demand response market design" is now available to download at www.usef.energy