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Nordic Energy Regulators
POWER THROUGH COOPERATION

Nordic Regulatory Framework for Independent Aggregation

28th February 2020

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Introduction

By gathering the loads of small customers and allowing them to shift their demand away from peak and constrained periods, aggregators can bring new benefits to consumers and help TSOs and DSOs to manage the energy system better. NordREG sees a great potential for aggregation in helping to manage network constraints more efficiently in the future and thereby to avoid costly investments in network expansions and upgrades. This innovation represents an important opportunity for the power system.

If aggregation can be supported independently of traditional suppliers, we could see some fundamental changes to the electricity sector with new economies and innovations of scope being introduced from other sectors. Companies not traditionally involved in electricity markets, such as transport, heating and refrigeration, could introduce new innovation into the sector and start supporting consumers to reap the benefits of supporting the energy system.

Companies specializing in traffic management for instance could use their expertise and data to focus on optimizing how and when electric vehicles are charged. Or groups of consumers behind a constraint could be empowered to offer geographically specific constraint management products to DSOs.

Customers are expected to benefit greatly from this innovation as it allows them to lower their energy bills when offering flexibility to the system. This new tool of demand response can be combined with other emerging trends in the retail sector, such as storage and small-scale local generation, and thereby enable us to put customers at the heart of the energy transition.

By increasing the flexibility in the power system, independent aggregators could therefore play a key role in allowing more intermittent generation onto the system, lowering constraint costs, optimizing market positions and increasing security of supply.

However, there are barriers to aggregation today that can prevent innovation and expansion in the sector. For instance, aggregators may need the consent of competing electricity undertakings, and face significant regulatory differences between Nordic countries. This paper outlines NordREG's position on how the regulatory framework can be improved to allow fair and efficient independent aggregation to contribute to the Nordic electricity system.

In support of the new opportunities and benefits that aggregation can bring, the Electricity Directive (hereafter 'The Directive') of the Clean Energy Package ('CEP') requires Members States to develop the role of aggregators. It stipulates that consumers must be able to choose an aggregator that can operate independently of and concurrently with a consumer's existing supplier, defining the new concept of an 'independent aggregator' (hereafter 'IA'). NordREG sees this as a significant opportunity to improve the operation of the Nordic electricity markets.

The issue of independent aggregation poses a number of relevant questions around balancing responsibility, metering, the relationship between different market participants, engaging consumers and how aggregation may look in the future. If we use this opportunity correctly, we will be able to

promote positive changes to energy markets that will promote new efficiencies and increase consumer welfare.

NordREG believes that the potential market for aggregation service providers should be adequately harmonized and not be limited to one country. This will maximize economies of scale and scope, enable more competition, and allow innovation in demand response to flow across borders.

This requires a consistent approach to the regulatory framework between countries to minimize cross-border barriers. The Nordic regulators have agreed to explore the possibility of a common Nordic solution that allows aggregators to deploy their business models across the region.

This is in line with the priorities of the Nordic Council's Electricity Markets Group and the Electricity Forum. To facilitate a Nordic harmonized approach for aggregation NordREG considers it necessary that the Nordic ministries develop a realistic road map, which builds on the initial experiences in aggregation. NordREG's first recommendation on legislative change is therefore to provide some legal structure to our attempts to integrate the Nordic market.

NordREG's role as regulator is to advise on the regulatory framework in which IAs can operate, not on deciding which specific IA business models should succeed in the marketplace. The market for aggregation services is in its infancy and it remains uncertain what the aggregator's exact role will be in the future power sector. With this in mind, we believe the regulatory framework should not be overly prescriptive, and refrain from limiting innovation in models for aggregation.

NordREG's recommendations in this paper therefore seek to increase the possibilities for different models of aggregation and not to limit them. We further encourage market actors to innovate in this area and to come forward with new models of aggregation where they are efficient.

However, any aggregation model must be compliant with the regulatory and legislative principles in the electricity markets. The regulatory framework must also be sufficiently flexible to allow IAs to operate in all market timeframes in a non-discriminatory and fair manner. It should allow fair markets to correctly price the services of aggregators in an environment that fosters efficiencies and minimizes externalities. If aggregators can contribute significant value to the power system, regulators need to ensure that they are able to do so efficiently.

The aim for NordREGs recommendations is not to specify which authorities should lead and develop the different work areas but rather to set out the need for a harmonized approach. In recognition of the different institutional arrangements in each Nordic country, ministries will need to decide which 'relevant authority' should be responsible for each of the recommended areas for work. The key here is that the relevant authorities in the four countries work together across the region.

Structure of the paper

In this paper, we outline our understanding of the specific requirements from the CEP and analyze these in the context of 4 regulatory areas:

1. general market access for independent aggregators
2. direct financial responsibilities for energy imbalances caused
3. compensation for unmatched positions caused by independent aggregators, and
4. measurement of flexibility

In analysing the regulatory areas, we will recommend **6 legislative changes** for ministries and legislators.

We also recommend **areas that will require further work** to modify the regulatory framework to complete implementation. We suggest that NRAs, system operators (TSOs and DSOs) and other actors start work on these areas once we have a stear from ministries on how they see the market framework developing.

With the need for Nordic coordination in mind, our first legislative recommendation is that:

Immediate legislative changes

> ***1:*** *Legislation should grant NRAs the authority to require system operators to implement a coordinated approach to independent aggregation across the Nordic market.*

Further work for implementation in the regulatory framework

> ***A:*** *Nordic ministries should work together to develop a road map and the agreed principles for the relevant authorities to implement their work in a coordinated manner across the region. The road-map should be built on the initial experiences in aggregation and include explicit deadlines for harmonization on all parties involved*

All recommendations are outlined at the end of each chapter and summarized in the last chapter for ease of reference.

1. General Market Access for Aggregators

The intention of the CEP is to remove the critical barriers for aggregators choosing to enter electricity markets and sign contracts with customers. One of the key barriers to market entry identified by aggregators has been that they are not treated on an equal footing to other market actors.

This is the reasoning behind independent aggregation, which allows aggregators to provide their services without being blocked by competing market actors, namely suppliers.

Aside the more practical requirements concerning the market arrangements, the Directive has specific requirements regarding the benefit that these changes would bring to the end-user, for instance:

> *Dir Recital (39): "...Member States should be free to choose the appropriate implementation model and approach to governance for independent aggregation while respecting the general principles set out in this Directive... The chosen model should contain transparent and fair rules to allow independent aggregators to fulfil their roles as intermediaries and to ensure that the final customer adequately benefits from their activities."*

The Directive can thus be seen to strongly link the requirements of introducing aggregation to the actual socio-economic benefits that they would bring. What this means in practice, is that the legislators will need to consider the big picture and future implications for the power system and existing market infrastructure, when drafting the arrangements concerning IAs.

As an example, introducing independent aggregation might require changes in data processing, which in turn induces costs. These costs might eventually be borne by the market participants and end-users. If these costs are expected to outweigh the socio-economic benefits that IAs would bring, the legislators should consider other alternatives. In line with the Directive, the changes that will be made, should ensure to bring measurable benefits to the final customer.

With this overarching requirement of improving consumer benefits in place, the CEP lays down 5 regulatory requirements for market access for IAs that should level the playing field to allow aggregators to provide their services on an equal footing to suppliers:

A. Access to 'all markets'
B. Non-discrimination
C. Data exchange
D. Customer access to aggregation without undue penalty
E. Aggregator access to the market without the approval of other market actors

These requirements need to be taken into account when assessing the other regulatory requirements in the CEP.

(A) 'All markets'

The Directive stipulates in several places that a customer, through aggregation, should be able to participate in all electricity markets. For example:

> *Article 17.1: … Member States shall allow final customers, including those offering demand response through aggregation, to participate alongside producers in a non-discriminatory manner in all electricity markets.*
>
> *Recital 39: … Products should be defined on all electricity markets, including ancillary services and capacity markets, so as to encourage the participation of demand response*

We understand this requirement to mean that IAs must be able to operate in all market types where there are technically able to do so. This will, as with all market participants, involve different models for aggregation and responsibilities depending on the market they are participating in.

There are a number of markets, in which aggregated flexibility and/or energy can potentially be traded through aggregation. Each of these markets has its own distinctive features and requirements, which may require different solutions and approaches in light of the identified regulatory areas.

NordREG's focus will be on ensuring IAs have the option to access the regulated energy markets. Therefore, IAs will need to be able to operate in the following types of markets in a consistent way across the region:

Day-Ahead and Intra-Day Energy Commodity Markets

These are ordinary energy markets involving pre-gate closure energy trading between market participants. In these markets participants trade energy between each other and not with the system operator, trading in advance of gate-closure.

Market participants are responsible for purchasing energy to cover their customers' demand, and they are responsible for the imbalances between the energy they purchased and the energy their customers used in real-time.

IAs need to be able to operate on these markets on similar terms to other market participants as 'Balance Responsible Parties'.

Balancing Markets

In these markets, system operators are responsible for managing imbalances and are the sole-purchasers of balancing products from market participants. This may include both real-time post-gate closure trading, and trading that takes place for balancing in advance of gate-closure. They include markets for frequency stabilization, constraint management and other ancillary services.

These markets may consist of products that have a significant impact on energy, for instance mFRR or aFRR. The market participants offer their energy for the system operator to be used in

accordance with specific technical requirements, such as minimum activation times or minimum bid sizes.

However, they may also include markets which are primarily concerned only with capacity, where the energy component may remain low. IAs need to be able to operate on these markets on similar terms to other market participants as 'Balance Service Providers' under the Electricity Balancing Guideline Regulation.

Local flexibility markets

Local flexibility markets are a proposed new market regime where the local DSO is the sole-buyer in a predefined area. It is envisaged that DSOs will procure flexibility services from IAs to manage internal constraints in the local distribution network in a more efficient manner.

The Directive, mainly through Article 32, paves the way for this new market regime by requiring Member States to provide incentives for DSOs to procure local flexibility services and to establish standardized products for flexibility services.

As EU regulation is increasingly placing legal obligations on DSOs to procure energy services based on transparent marked principles, it appears likely that DSOs may lose their power to freely activate 'dispatchable demand response'[1] at their discretion.

To complement arrangements already in place to support demand-response at DSO-level[2], we expect the establishment of local flexibility platforms in the future. In these markets IAs may aggregate dispatchable demand response, compete with other IAs based on market prices and offer their services to DSOs. Through this marked-based approach, the DSOs' true willingness to pay for these flexibility services may be fully revealed and thus provide the power sector with a better understanding of the market value of dispatchable demand response.

It is our understanding that this new market regime, whilst operating on a different scale, would run in a harmonized way with the TSO-led balancing markets and require some sort of linking of bids between the two platforms.

NordREG will need to further asses the opportunities and challenges of local flexibility markets when the related market concepts have reached a sufficient level of maturity. There are currently a variety of different proposed market designs in Norden that differ significantly from each other. The fact that local flexibility markets are not yet established is helpful in this regard as it means that regulators and the industry are able to carefully consider the needs of IAs when developing these markets.

[1] Dispatchable demand response: Mostly industrial demand customers who have entered into a contract that allows DSOs to reduce their demand during constrained periods. These customers typically receive an annual capacity payment as compensation.
[2] Currently, DSOs in some Nordic countries offer special contracts with lower connection charges to consumers who are willing to provide flexibility to the DSO within a predefined time period

(B) Non-discrimination

The service of independent aggregation or its customers cannot be treated in a discriminatory way. The Directive requires that:

> *Art. 13.4: Member States shall ensure that the rights …are granted to final customers in a non-discriminatory manner as regards cost, effort or time. In particular, Member States shall ensure that customers are not subject to discriminatory technical and administrative requirements, procedures or charges by their supplier on the basis of whether they have a contract with a market participant engaged in aggregation*
>
> *Art. 17.2: Member States shall ensure that transmission system operators and distribution system operators … treat market participants engaged in the aggregation … in a non-discriminatory manner … on the basis of their technical capabilities*
>
> *Art. 17.3(e): provision for final customers who have a contract with independent aggregators not to be subject to undue payments, penalties or other undue contractual restrictions by their suppliers*

This means that other market participants must not impose undue costs, including effort and time, on customers who enter into a contract with an IA. This includes the supplier or DSO not being able to impose additional costs or effort on the customer because of an IA agreement. However, the contract with the IA may involve reasonable and transparent additional costs for technical modifications, such as metering requirements.

From the IAs perspective, this means system operators and market rules cannot discriminate against or in favor of IAs beyond the technical limitations of IAs. The NordREG understand this to mean that where IAs and other market participants are trading similar products, rules should be clear to ensure IAs are not treated differently, worse or better, from other market participants.

This requirement should be taken into account when implementing all other provisions in the Directive.

Treatment by System Operators

When designing the market rules, following Article 17.2, it is important to make sure there is an equal treatment in the pre-qualification process for all participants in the markets. Furthermore, requirements that are not problematic for traditional market participants may provide serious barriers against aggregators participating in markets.

While certain aspects of pre-qualification for aggregated products may be needed to ensure the products can be used in the relevant markets, and to ensure that products are delivered in a way that maintains system security, system operators (TSOs and DSOs) should be careful not to impose disproportionate pre-qualification requirements that significantly harm the ability of an aggregator to assemble a bid.

Furthermore, NordREG have understood that there are concerns that the differentiation of pre-qualification requirements between system operators in the region can cause significant barriers to market entry between Nordic countries. Market participants including aggregators argue that they are able to develop their business and products in one Nordic country, but are then finding they cannot export their model for aggregation to neighboring countries because of different pre-qualification requirements there.

Building on the work of the Nordic Balancing Market, for aggregation to bring the most benefit to consumers, the rules for pre-qualification for products that aggregators provide should be closer aligned between system operators, allowing more competition and innovation between aggregators across national borders. As with all BSPs, the fewer changes that an aggregator needs to make when exporting their model of aggregation into another locality, the stronger the case they have for making such a move.

These benefits will need to be weighed against any locally specific security of supply requirements that are needed in the pre-qualification process.

The resulting pre-qualification could also be relevant for the foreseen local flexibility markets in order to facilitate participation by aggregators in all markets, including local flexibility markets. Enabling aggregators to bid in their flexible resource in all markets would not only utilize the flexible resources better, but also increase the competition on the demand side. This is especially the case in the foreseen local flexibility markets and some balancing markets where there would only be one buyer.

(C) Data exchange

For aggregation to bring the most optimization value to electricity markets, the right level of data exchange must be found between IAs and other market participants.

> *Art. 17-3: Member States shall ensure that their relevant regulatory framework contains at least the following elements:*
>
> *(c) non-discriminatory and transparent rules and procedures for the exchange of data between market participants engaged in aggregation and other electricity undertakings that ensure easy access to data on equal and non-discriminatory terms while fully protecting commercially sensitive information and customers' personal data*

At a basic level, this means that IAs should have the same responsibilities for data reporting as other electricity undertakings involved in the same markets. This will need to be taken into account when implementing the Data Hub projects.

Given that IAs and suppliers will provide services to the same customer at the same time, there may also be data exchange requirements between these two parties to ensure an efficient operation of the markets. However, such data exchange will need to be balanced with the principals of non-

discrimination, and avoid forcing one party to share commercial confidential information to the detriment of the market overall.

(D) Customer's right to independent aggregation alongside their supplier

The core innovation in independent aggregation is that consumers are able to contract aggregation services without the consent of their existing supplier. An aggregator is 'independent' when it is not affiliated to nor needs the consent of the customer's existing supplier or other existing electricity undertakings (including other IAs) before signing the contract with the customer.

> *Art 13.1-2: (1) Member States shall ensure that all customers are free to purchase and sell electricity services, including aggregation, other than supply, independently from their electricity supply contract and from an electricity undertaking of their choice; (2) Member States shall ensure that, where a final customer wishes to conclude an aggregation contract, the final customer is entitled to do so without the consent of the final customer's electricity undertakings.*

For avoidance of doubt, this provision does not imply that suppliers are unable to provide aggregation services, nor does it imply that IAs are unable to provide supply services. The article is drafted to protect customers and should be interpreted from the customer's perspective, in line with the intentions of the directive stated in the recitals[3].

Here, 'electricity services' are services beyond conventional supply of electricity provided directly by the IA to the end customer, and not services that the IA is selling to other electricity undertakings or the system operator. These are services to enable the customer to participate more actively in markets through aggregation.

The Directive indicates that an IA may provide these services independently of a customer's supplier. This means that customers are free to enter into a contract with an IA for these services without the customer's supplier being able to prevent this. In line with the non-discrimination requirement, this also means that the supplier cannot impose undue cost or effort on the customer if the customer chooses to sign a contract with an IA.

An implicit requirement here is that customers are entitled to have more than one electricity undertaking, including IAs and traditional suppliers, without undue costs being imposed on them. Consumer protection legislation should reflect this fact.

The customer's right to voluntarily contract with an independent aggregator needs to be accompanied by sufficient consumer protection. The Directive prescribes that the customers has a right to switch aggregator and that the independent aggregator is to fully inform the customer of the contractual terms and conditions.

[3] In other words, the first sentence says that customers are entitled to purchase electricity services, beyond those simply offering supply, without the consent of their original supplier. An alternative interpretation of this statement requiring unbundling is neither supported grammatically in the text, nor in the recitals of the directive.

(E) Aggregator's right to freely offer their services

IAs can provide aggregation service to customers without the consent of other market participants. It therefore must be possible for an IA to have a contract with a customer without the existing supplier requiring any form of mutual agreement with the IA.

> *Art. 17.3: Member States shall ensure that their relevant regulatory framework contains at least the following elements:*
>
> *(a) the right for each market participant engaged in aggregation, including independent aggregators, to enter electricity markets without the consent of other market participants…*

This clarifies that other suppliers are not able to force conditions or fees on IAs.

Because the provision focuses on prohibiting the requirement for 'consent' from other market participants, it cannot be a legal requirement for IAs to enter into a contract with a customer's other supplier (or their BRP) where the customer's other supplier has the ability to use these negotiations to inhibit the IA signing the agreement with the customer. The IA must have a sufficient degree freedom as to how to manage their balance responsibility in a similar way to traditional suppliers.

This requirement has a number of important implications for the regulatory framework and market design that will be addressed in the remainder of the paper.

Market Access Recommendations

Immediate legislative changes

2: *Electricity consumer protection legislation should be reviewed to ensure that suppliers cannot introduce undue costs on their customers if their customers choose to contract with an aggregator.*

3*: Legislation should require system operators to agree to a more harmonized approach to pre-qualification to provide a level playing field for aggregators within a specified time*

Further work for implementation in the regulatory framework

B: *The relevant authorities should assess whether there is a need for data exchange between electricity undertakings servicing the same customer for the efficient operation of the market, and if so, what these requirements should be*

C: *System operators should propose and the NRAs should approve a road-map and clear deliverables on harmonisation of pre-qualification requirements to remove barriers to aggregators operating between countries in the region*

D*: Once the regulatory framework for independent aggregation is in place, NRAs and system operators should review the development of local flexibility markets to ensure independent aggregators are not facing undue barriers*

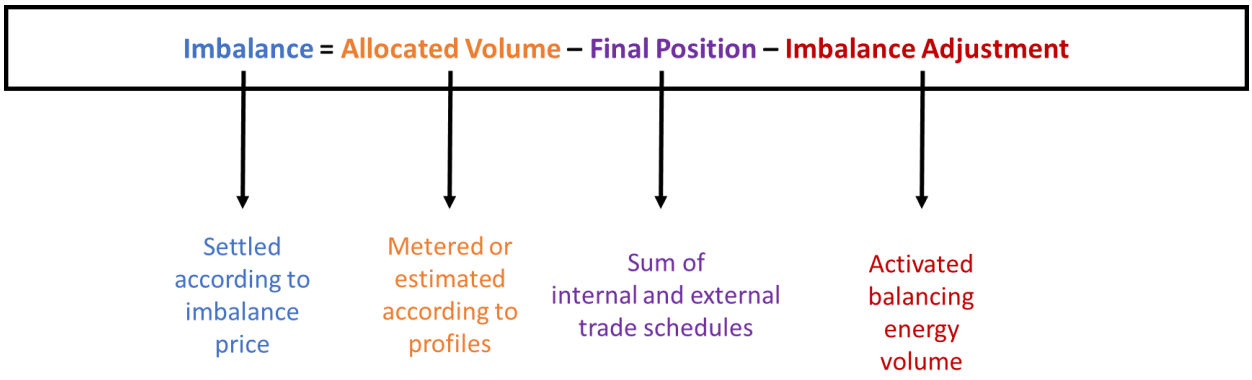
2. Organizing responsibility for energy imbalances

The Directive is clear that aggregators, including IAs, must be financially responsible for the energy imbalances they cause.

> *Art. 17.3(d): an obligation on market participants engaged in aggregation to be financially responsible for the imbalances that they cause in the electricity system;*
>
> *to that extent they shall be balance responsible parties or shall delegate their balancing responsibility in accordance with Article 5 of Regulation (EU) 2019/943*

'Responsibility for imbalances' means different things for different roles, but it is limited to the direct responsibilities under these roles[4].

The Electricity Balancing Guideline introduces a distinction between roles of Balance Responsible Parties (B**R**Ps) and Balancing Service Providers (B**S**Ps). A B**R**P is responsible for imbalances caused between its final position and its allocated volumes, taking into account any imbalance settlement adjustments. A B**S**P sells products directly to system operators in the balancing markets and is responsible for delivering its committed products and allowing its actions to be deducted from the BRPs imbalances (imbalance adjustment).



1: Overview of Imbalance Settlement Components

These roles are now separate, allowing market actors to opt for either just one of these roles or both. We will therefore define two types of IAs and assess the regulatory frameworks for them in the respective market places they would operate:

- IA operating in balancing markets with BSP status ('B**S**P-IAs'); and
- IA operating in commodity markets with BRP status ('B**R**P-IAs')

Alongside these are the same roles adopted by the customer's original supplier: BRP-supplier and BSP-supplier. Both suppliers and IAs can choose to contractually delegate their balancing

[4] For the avoidance of doubt, responsibility for unmatched positions of a BRP caused by a BSP-IA are not included here. This issue is dealt with in Part 3

responsibility to third parties, but cannot operate in the respective markets without managing these responsibilities in some form[5].

Following the market access requirements of the last part, BRP-IAs and BSP-IAs must be able to operate 'independently' of the customer's existing BRP-supplier or BSP-supplier. That is, an BRP-IA must be able to act without the consent of the customer's existing BRP-supplier and BSP-supplier.

Any solution in the regulatory framework must allow for a contractual solution to how these balance responsibilities are shared. Such a contractual arrangement could in theory allow for balancing responsibility to be settled commercially. It could also allow any distribution of unmatched positions between the customer's original supplier and the IA to be settled through contractual agreement.

However, if contractual solutions are not possible between the parties, the market access requirements are clear that there must be alternatives for IAs to distinguish between their responsibilities and those of the customer's other electricity undertakings without their consent, in an economically efficient manner. We will discuss these in the context of each role in its relevant market types. Given that most discussion in Norden to date has been around BSP-IAs, we will start there.

BSP-IAs on Balancing Markets

In balancing markets, market participants commit to delivering balancing products to system operators to stabilize frequency and manage constraints. It should be possible for an IA to operate as a BSP within balancing markets, and sell these services to system operators, on an equal footing with other balancing market participants.

BSP-IAs do not have a direct imbalance responsibility to a customer's BRP-supplier. However, it is still necessary to distinguish their actions from the actions of the customer's original supplier for two reasons:

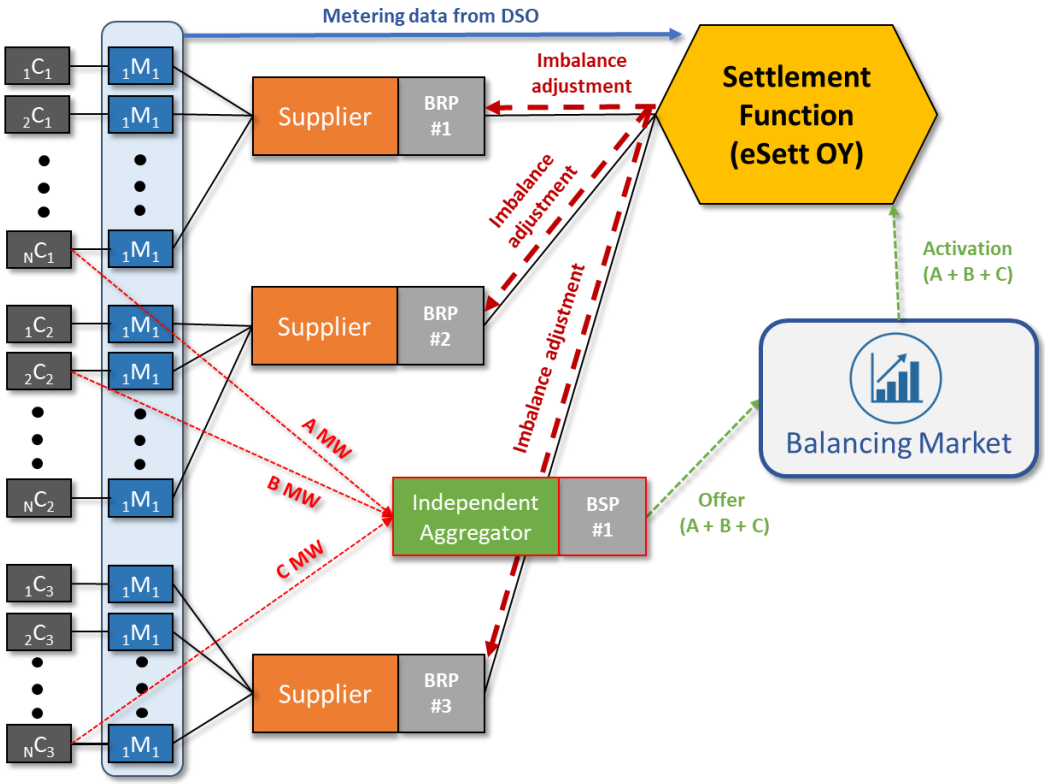
1. The energy imbalance caused by all BSP actions must be deducted from the *relevant* BRP's imbalances. Thus, BSP-IA actions must be distinguished from the BRP-supplier (see Part 4)

2. Just like all other BSPs participating in the balancing market, BSP-IAs would still be obliged to pay the system operator if they fail to deliver the products they sold. This is the financial responsibility for their imbalances in the balancing markets. Thus, BSP-IA actions must be distinguished from the BSP-supplier

As figure 2 below demonstrates, this becomes a highly complex task, as an BSP-IA can have customers with several suppliers as both BRP and BSP. Thus, following the Electricity Balancing

[5] In this paper, the BRP-IA or BRP-supplier will also cover parties that have delegated this responsibility to another BRP

Regulation[6], it should be possible for an BSP-IA to aggregate customers' flexible resources for a bid that is split across several BRPs and thus several suppliers. This is also in line with the market access requirements in the Directive.



2: Overlapping data flows for IAs alongside suppliers

Leaving the question of measurement of flexibility until Part 4, a clear, unbiased and simple solution for managing this data and separating these responsibilities is essential. TSOs have been developing solutions to this challenge, focusing on the data processes involved.

TSOs need to assess who is responsible for handling the relevant data and who is responsible for deciding how the financial responsibilities are split between BRPs in a fair and unbiased manner. For instance, it would be problematic if the BSP-IA was responsible for allocating their imbalance adjustments between BRPs. This could lead to BSP-IAs shifting imbalance costs away from preferred BRPs and towards competitor BRPs.

NordREG believes that TSOs need to take into account the following when developing these processes for distinguishing the flexibility from an BSP-IA from other consumption:

1. **No contractual requirement**: the rules should *not* prevent fair contractual resolution between BSP-IAs and other market actors, but cannot rely on them. That is, it must be

[6] Art. 18.4(d): *"…each balancing energy bid from a BSP is assigned to one or more BRPs for calculation of an imbalance adjustment"*

possible for an BSP-IA to provide the right data so that its actions can be used to distinguish its responsibilities from other BSPs and BRPs *without* needing a contract with a BRP. Contracts are only needed if they can optimize welfare for both contracting parties.

2. **Customer's cannot be penalized:** following the market access requirements in the Directive, it cannot be possible for BRPs to penalize their customers for the actions of an BSP-IA.

3. **Harmonization from BSP perspective:** TSOs should coordinate their approach to handling data on balance responsibilities as much as possible. Even if the internal data handling processes cannot be fully harmonized, BSP-IAs should 'not notice' the difference. That is, the systems and business model of an BSP-IA in one Nordic country should be deployable in another Nordic country, without having to significantly change its business model or IT systems to manage this. This would constitute a cross-border barrier to the Nordic market for aggregation services.

4. **Fair:** The approach taken by TSOs should not allow significant bias for one party. It should not put one party in a significantly stronger position over the other. This applies equally to BRPs not being able to use leverage to penalise BSP-IAs, as it does to BSP-IAs not being able to use leverage that harms BRPs or discriminates between them.

5. **Proportionate**: The burden of any data managing and imbalance responsibility allocation system needs to be weighed against its benefits. Ideally, the solution should be able to apply to aggregated small households or to larger units. However, if the burden would be inefficiently costly on small households, alternatives should be considered.

Much of this work is ongoing through the implementation of the Electricity Balancing Guideline, but TSOs will need to work closely together to ensure that this will work in a harmonized way that implements the requirements of the Directive.

BSP-IAs on Local Flexibility Markets

Local flexibility markets are still under development but are likely to play a critical role in local constraint management and may involve DSOs instead of just TSOs purchasing products from IAs and other actors.

There are currently a variety of projects in Europe proposing the establishment of a market platform for local flexibility services. We expect these projects to be compliant with the requirements in the Directive in regard to IAs. It remains to be seen which of these projects will receive most support from the industry and ultimately transform into mature and competitive business models.

As this area develops, we need to ensure that any local balancing markets align with the regulatory framework here, to ensure that IAs are treated on an equal footing with other market participants at the local level as well.

BRP-IAs on the Commodity Markets

Following the directive and the logic of the Nordic commodity markets, if an IA wants to trade in the DA or ID markets, it must be financially responsible for its imbalances. This means it must either be a BRP, or contract with a BRP.

In practice, this means that it must be responsible for a given allocated volume and its final position at gate-closure, with the financial responsibility for the imbalance between these two.

For BRP-IAs that produce energy, this means the responsibility for ensuring that their customers' deliver of energy to match their final position. For BRP-IAs that manages the demand of its customers through aggregating flexible demand-response, this means they are responsible for the allocated volumes of their customers for the flexible resources they contract to aggregate. All BRPs that have responsibility for a consumption load are responsible for matching this load with energy, IAs included.

Alternative models have been proposed where an IA could use its allocated consumption volumes to sell negative production to the market. At the moment, NordREG cannot see how such as system would work in practice in the DA market that would be fair to other BRPs, and cannot see a justification for such an arrangement in the Nordic markets.

In practice, the requirement for IAs operating in the commodity markets to hold or assign balance responsibility means that they would be operating similarly to suppliers, needing to be or contract with a BRP for this portion of the customer's load. But instead of for a customer's entire load, the BRP-IA would only need to manage balance responsibility for the discrete element of load covering the flexible resource in their contract with the customer.

Demand flexibility in commodity markets

This means that in the Nordic *commodity* markets, 'demand-flexibility' is less about delivering flexibility as a unique product type, and more about the BRP-IA being able to control the flexible loads and so more effectively manage the allocated volumes of its customers than a traditional supplier could.

It is certainly possible for existing suppliers to also offer these services to their customers. However, in practice they are not doing so. They are also required to manage the entire load of the customer prompting a different business model to a specialized BRP-IA.

Because BRP-IAs can take responsibility for on a discrete element of a customer's load, and one that they can control directly, they would operate under a different business model compared to the traditional 'whole-load' suppliers. They may for instance specialize in just aggregating and optimizing demand for EV-chargers or heat-pumps. This could allow new economies of scope from other sectors, such as the heating or even e-mobility sectors to bring innovation into the energy sector.

'Independence' of the BRP-IA

Following the requirements of the Directive, it must be possible for customers to have better control over their electricity by being able to contract with an BRP-IA separately and in addition to their BRP-supplier. However, the relationship between these two needs to be managed somehow, since the operate behind the same DSO metered connection point. Under current laws, each connection point can only have one BRP, that both parties would need to contract with.

Requiring IAs to contract with a customer's existing BRP is non-compliant with the Directive, and constitutes a barrier to entry for aggregators. A customer's actual BRP is often owned by, or at the very least is dependent on, the customer's supplier so it is not behaviorally useful to distinguish a customer's BRP and their supplier. Given market access requirements and the Directive's definition of an IA, such contracts with the customer's existing supplier or their BRP cannot be mandatory for the IA to contract with a customer.

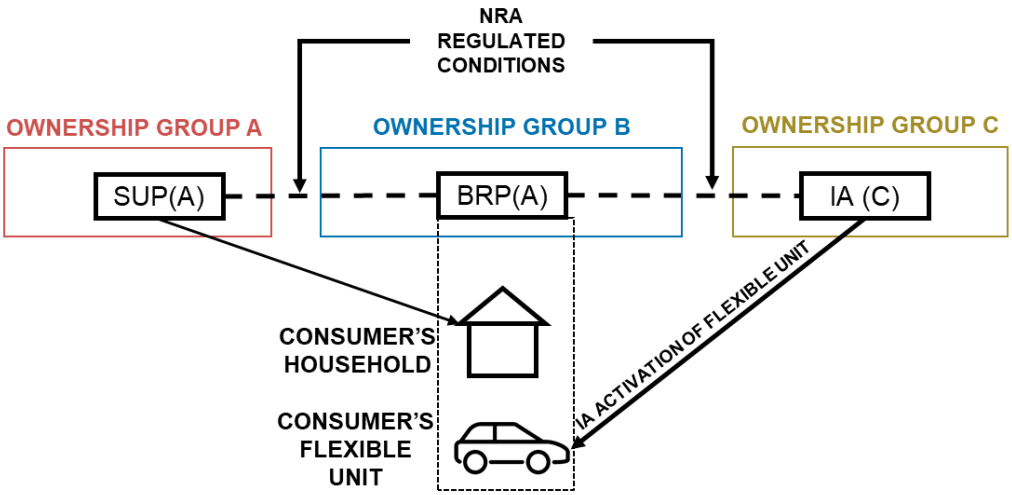
We assess three solutions to deal with this problem:

1. BRP unbundling from suppliers
2. Single BRP with regulated conditions
3. Multiple BRP/commercial solution

While each solution presents problems and risks, we believe that the last of these presents the lowest level or risk, and the most opportunity for markets to operate efficiently.

1. BRP unbundling from suppliers

If a customer's BRP is separate from its supplier, then it could be argued that the IA would need to sign a contract with customer's existing BRP separately, provided that the customer's supplier has no influence over negotiations.



3: Unbundling BRPs and suppliers

As figure 3 shows, in practice this would mean that BRPs would need to be unbundled[7] from their suppliers to fulfill the market access requirements in the Directive. Suppliers would then be in the same position as IAs, both needing to contract with the customer's existing BRP.

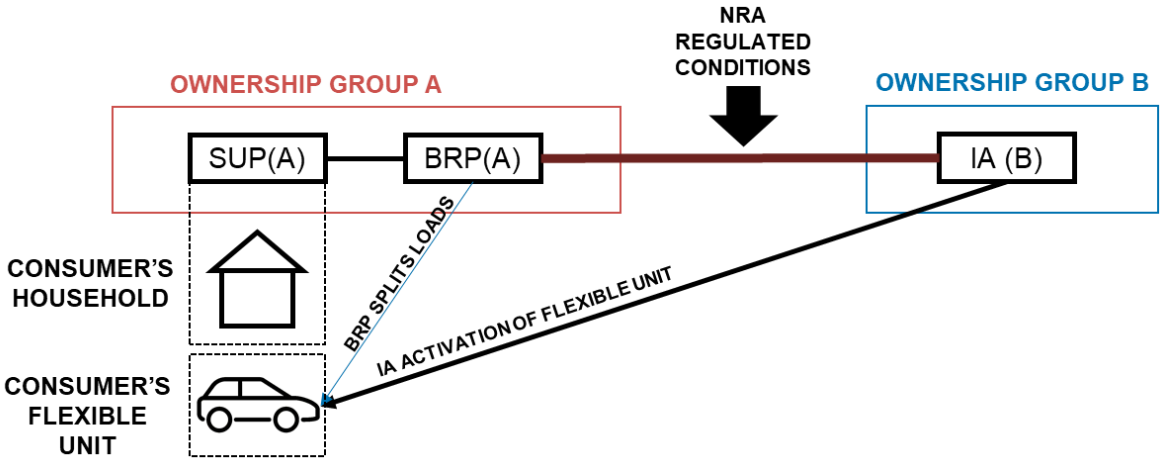
However, this appears an extreme solution and could pose significant risks around the uncertainties this would cause. There are commercial reasons that some suppliers (and possible IAs) choose to handle their own imbalances, and these would need to be traded-off against the gains of such unbundling. Such a solution could be a disproportionate response to the question at hand.

There are also many practical problems, such as how the customer's BRP would be fixed independently of either the supplier or IA, or how the contract between the BRP and the original supplier would be impacted.

NordREG does not recommend this solution.

2.Single BRP with regulated conditions

If customers are only permitted to have one BRP at a time, another alternative is to prohibit the customer's BRP and thus their supplier from being able to refuse an agreement with the IA. In practice, the normal market conditions for a commercial contract negotiation would be distorted as one of the negotiating parties would not have the option of withdrawing from the contract[8]. This would allow IAs to impose their preferred conditions[9] on BRPs at the expense of the existing supplier, as shown by the line between the BRP and the IA in figure 4.



4: Regulated conditions single BRP

In order to prevent IAs abusing this dominant position, state intervention would be required in the negotiation of these conditions between commercial market participants. NRAs or ministries would

[7] 'Unbundelling' referes to the separation of two functions originally held by the same company.
[8] Note, if the only option for a customer's BRP to withdraw from negotiations was to terminate their contract with the customer, this would also be problematic under the Directive, and discriminatory against customer's existing suppliers
[9] 'Conditions' is more approriate than 'contract' here, as the BRP would not be able to enter or withdraw from negotiations freely

have to either settle disputes in these negotiations or provide detailed specifications for what these conditions should look like.

NordREG believe that such a solution is problematic as it is not legally certain that such a relationship would fulfil the definition of 'independent aggregator' in the Directive, but more importantly would lead to very detailed microregulation in a relatively new market.

In practice, NRAs would then be deciding on how balance responsibility has to be settled behind one meter between two independent market participants. It would mean that, instead of settling this information asymmetry through market arrangements, the NRAs would need to establish detailed rules and fully regulated mechanisms. As these rules and mechanisms will be imperfect in one sense or another, this solution is very likely to create winners and losers amongst market participants.

Additionally, such an approach would limit the business models for aggregators, forcing them to set potentially different terms for all customers with different BRPs to sell the same product, rather than select a single preferred BRP model.

Thus, this option is legally uncertain and would involve a high degree of market intervention.

3.Multiple BRP commercial

The final alternative is to allow a customer's load to be split between more than one BRP in the commodity markets, or allow a standard system for TSOs to split the BSP load within a customer's BRP.

This would allow bilateral contracts between an IA and a customer's existing BRP become optional for both parties. This allows an unregulated commercial contractual negotiation to take place between an IA and a customer's existing BRP, since both parties are free to withdraw from the agreement.

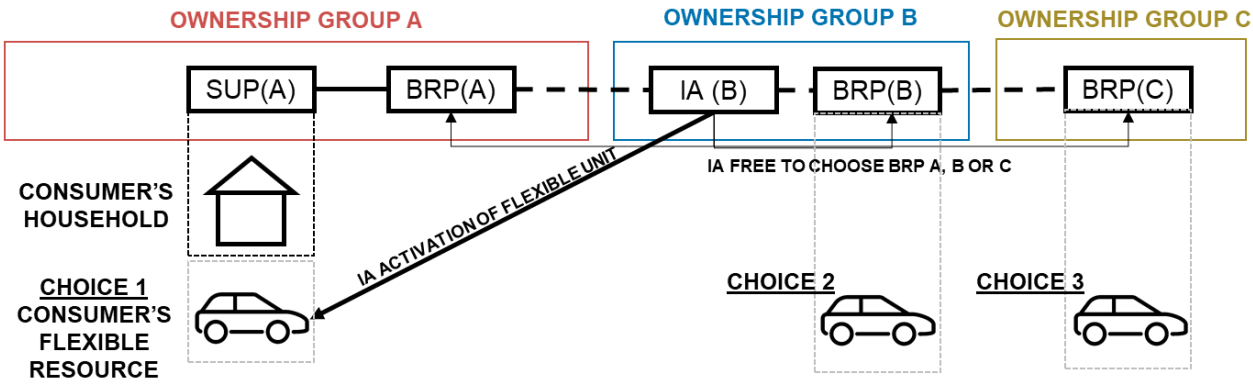
Issues around the BRPs contract with the existing supplier and supplier's control over the BRP would not be a significant barrier to market entry for IAs choosing to enter either market group if they do not need to rely on a contract with the customer's existing BRP.

If either the IA or the customer's supplier/BRP do not wish to agree a contract, the IA is then able to split balance responsibility for the customer's load between the flexible resource and the rest of the customer's load, therefore lettering the BRP-IA choose their own BRP, or equally submit information on their BSP responsibilities directly to the TSO.

The multiple options open to an IA are shown in figure 5, where they have 3 choices of how to manage their balance responsibilities. Namely, the IA can contract with a customer's existing BRP (choice 1), be their own BRP (choice 2) or delegate to a third BRP who handles their imbalances across multiple customers within one contract (choice 3).

A customer's supplier that controls its own BRP is able to refuse a contract with the IA. Likewise, the IA is able to sign a contract with the customer without the consent of the customer's existing

supplier by separating their financial responsibilities for imbalances from those of the existing supplier.



5: Multiple BRP / Commercial solution

Notably, this solution would also be in line with Article 4 of the Directive, which stipulates customers should be free to have more than one electricity supply contract at the same time, provided metering requirements are met.

The elements of a customer's load that are the balance responsibility of the IA and which elements remain with the original supplier should be clearly defined in the contract between the IA and the customer. The customer's original supplier should be informed of which elements are now the responsibility of the IA participating in these markets, in a similar way to being informed if the customer switched to a new supplier.

NordREG prefers this solution as it is more market oriented, and opens more options and potential business models to both aggregators and suppliers.

The biggest challenge of the multiple BRP-solution is the costs incurred when setting up the required IT and data management systems allowing to split the load. It is notable that such a solution to splitting a customer's load between multiple BRPs must be possible in practice for this solution to work. In addition, it must be proportionate to the benefits of independent aggregation, and it must internalize and minimize costs for consumers. We discuss these issues in Part 4.

Balance Responsibility Recommendations

Immediate legislative changes

4: *Market participants, including aggregators, should have the right to split the financial responsibility for a customer's energy imbalances at a single connection point, as long as:*

1) *they have the consent of the customer to do so*
2) *it is technically feasible, and*
3) *the costs of allowing such split are proportionate to the benefits*

In practice, this would mean that market participants are able to request that more than one market actor can be a BRP for the same DSO-metered connection point if adequat metering is cost-effective and in place.

The approach to this should be coordinated as far as possible accross the region to enable the most efficient economies of scope and scale

Further work for implementation in the regulatory framework

E**:** *The relevant authorities should aim at a close harmonisation of the requirements on BSPs and their relationship to BRPs under the implementation of the Electricity Balancing Guideline, and take into account the principles outlined in this paper*

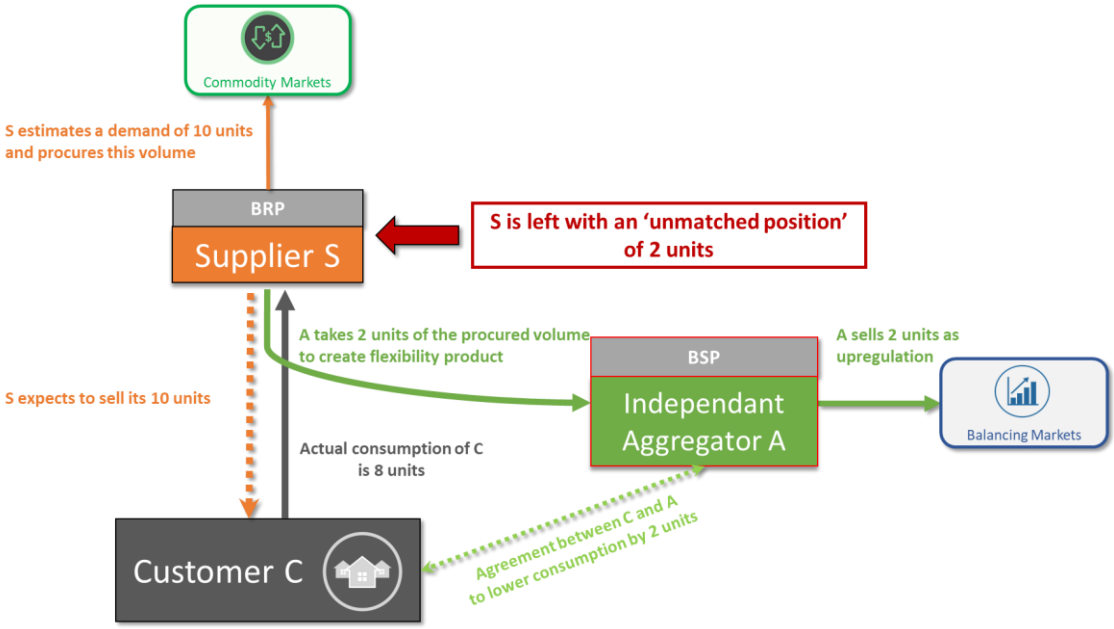
F: *The relevant authorities should clarify the requirements on BRP-IAs operating in the energy commodity markets, enabling them to operate on an equal footing to traditional suppliers subject to technical requirements. This should take into account NordREG's recommendation on not allowing IAs to use consumption volumes to place negative production bids*

3. Compensation for unmatched positions caused by aggregation

An 'unmatched position' is when a supplier buys energy to match the estimated demand of their consumers, after which, the actual consumption was different from what the supplier purchased prior to gate-closure. Here we are concerned by the portion of a supplier's unmatched position that is due to an IA triggering demand-response for a supplier's consumer.

For instance, an IA's BSP in a balancing market, causes a BRP to miscalculate their customers' energy demand in the commodities market and therefore purchase too much or too little energy for their customer. This means that the customer's electricity supplier will have purchased energy that it was unable to sell to the consumer, resulting in lost value. In effect, the BRP or supplier purchased energy for a customer, that was then no longer required due to the BSP altering the customer's demand in real-time.

As an illustrative example:



6: Unmatched positions caused by a BSP

- Supplier S (BRP-supplier) procures 10 units of energy in the wholesale market for its Customer C (as S expects C's demand to equal 10 units).
- C intends to consume 10 units but has a flexibility contract with the aggregator A (BSP-IA).
- A can control 2 units of C´s demand from a flexible resource
- A resells the negative 2 units volume in an aggregated bidding-object as upregulation for a higher price in another market
- Thus, C delivers the 2 units upregulation only consuming 8 units, and receives compensation from A for the flexibility
- S (the BRP) is left with excess energy costs as they can only sell 8 units to C after having purchased 10 units. The remaining 2 units represent the supplier's excess energy which S

> cannot recover the costs for from C. That is, S's 'unmatched position' caused by the aggregator

Notably, the supplier is not always negatively impacted by the IAs action. If, for instance, the supplier underestimated demand, or did not purchase a sufficient amount of energy prior to gate-closure, then the actions of the aggregator will help the supplier reduce their imbalance costs. In our example, if S's final position was 6, they would have purchased 4 units below C's un-altered demand, but in real-time, IA meant they only purchased 2 units too many instead of 4. Thus, IA would have 'helped' S.

Basis for compensation

The Directive does not provide concrete guidance to Member States on how to solve the issue regarding residual unmatched positions for the existing supplier of a consumer, and thus NordREG expects there to be fairly different solutions across Europe.

However, Article 17(4) in the Directive gives Member States the possibility to put in place an appropriate compensation mechanism, provided that this mechanism (i) does not create undue barriers to market entry, (ii) does not overcompensate and (iii) is non-discriminatory.

> *Art. 17.4: Member States may require electricity undertakings or participating final customers to pay financial compensation (…), if those market participants or balance responsible parties are directly affected by demand response activation.*
>
> *Such financial compensation shall not create a barrier to market entry for market participants engaged in aggregation or a barrier to flexibility.*
>
> *(…) the aggregators or participating customers may be required to contribute to such compensation but only where and to the extent that the benefits to all suppliers, customers and their balance responsible parties do not exceed the direct costs incurred (…)*

Compensation for unmatched positions is the monetary transactions between the electricity undertakings holding contracts for the same customer (in our case S and A) to cover the costs of unmatched positions. It is possible that such compensation schemes could arise from negotiations between an IA and a customer's BRP.

However, following the market access requirements, compensation contracts between the BRP and the IA can only be a voluntary action as the IA must be free to provide its services without such a mutually consensual agreement with a customer's existing supplier or its BRP. If the Nordic ministries agree that compensation is necessary, it follows that the default option must be a regulated process.

Overall, the Directive can be interpreted in giving Member States three options: no compensation, partial compensation, or full compensation. It leaves open the question of who should pay for such

compensation, but specifies that this cannot impose a 'barrier to market entry' for IAs, and cannot exceed the socio-economic benefits.

This may not be an issue for all balancing markets. If BSPs are trading capacity products that do not have a significant impact on the energy imbalances of BRPs, then compensation will not be necessary. Thus, the impact of compensation for unmatched positions to BRPs is most relevant for balancing markets where energy is significantly impacted by the actions of other BSPs.

Causes and responsibility for unmatched positions

IAs benefit from suppliers being able to reduce energy volumes from their consumers and sell them as flexibility products in other markets (e.g. balancing markets) without procuring these volumes in commodity markets. In this process, IAs skim off a large share of the total welfare gains. In contrast, the supplier's balancing responsibility turns into risk that is increasingly difficult to predict as the supplier's final position is now significantly affected by the actions of BSP-IAs.

It can be argued that this leads to undue cross-subsidization and discriminates between suppliers and IAs. To mitigate these adverse effects, a one-to-one compensation for imbalances from A to S has been identified as possible option. Going back to our example, it would mean that A has an obligation to compensate S for the 2 units priced according to, for instance, the spot price.

In reality, however, the situation is not as straightforward as it first appears since Customer C does not commit in any way to the volumes procured by S in the wholesale market. C is only financially liable for its final consumption and may freely choose to consume less energy. The supplier has a responsibility to correctly anticipate C's demand when procuring energy in wholesale markets. Should this include the actions of the BSPs?

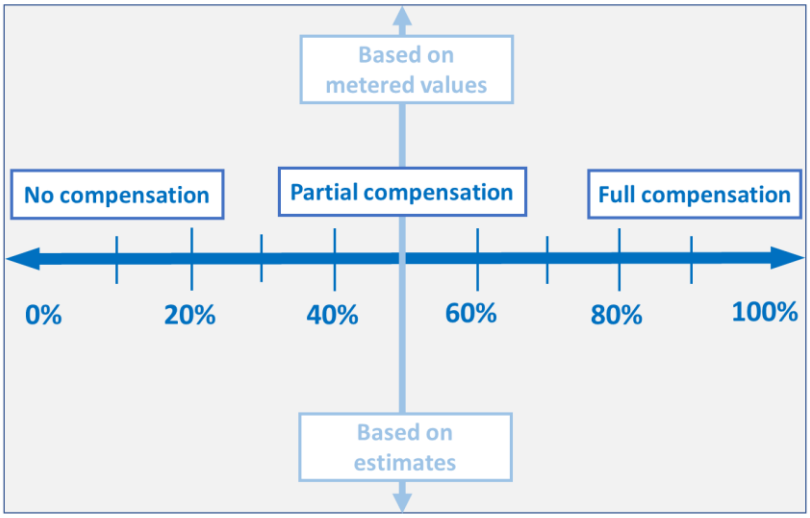
It has therefore been argued that the supplier's balancing responsibility should include a responsibility to estimate the impact of A's actions as part of their demand forecasts. In addition, Member States may wish to strengthen the business case and role of IAs and thus choose to exempt them from paying these additional costs.

There remain crucial questions to be resolved. How much of the total imbalance cost should be compensated? Will a fraction of the imbalance costs be socialized to foster independent aggregation? Will the compensation threshold remain the same or change over time?

Compensation payment

There are three approaches to how much of the unmatched position should be compensated:

1. **No compensation** – full cost of the unmatched position is on BRP/original supplier
2. **Partial compensation** – cost of the unmatched position is shared
3. **Full compensation –** full cost of the unmatched position on IA (or spread across consumers)



7: Range of options for compensation

1.No compensation

NordREG acknowledges that suppliers may, over time, be able to adjust their economic models and make reliable predictions about the IAs' actions. However, we are concerned that no compensation may lead to significant distortive effects and harm the competitive and well-functioning retail markets in the Nordic countries[10].

We therefore advise against a 'no compensation' model for the immediate future on the following grounds:

- Suppliers will not have access to reliable benchmark regarding the magnitude of imbalances caused by IAs in the first 2-3 years after implementation. Requiring suppliers to reliably predict the IAs' actions from day one therefore appears to be disproportionate.

- Providing no compensation may, in the long run, harm supplier competition in the Nordic markets raising costs for consumers. The additional costs and risks suppliers will take on from trying to match positions will be more difficult for smaller suppliers or new entrants to manage. This may force smaller suppliers to exit the market and thus weaken competition. One of the strengths of the Nordic energy market is the high number of competitive energy suppliers. We should be cautious of risks to this competitive market.

- A no-compensation model would also seem to give unfair benefits for the aggregator by imposing costs on the supplier

[10] In addition, as discussed in Part 4, if flexibility baselines are linked to final positions of suppliers at gate-closure then the better suppliers get at predicting the actions of aggregators, the more difficult it will be to estimate how much flexibility is actually being delivered.

- Even several years after implementation, we consider it unlikely that suppliers will be able to foresee all actions of IAs, particularly in periods of sudden scarcity and in the light of higher shares of intermittent generation in the system. Even the most robust forecast models are unlikely to be able to shield suppliers against these financial losses.

- NordREG is not convinced by arguments stating that no compensation should be given on the ground that independent aggregation is still in its infancy and may not cause significant imbalances. NordREG considers it regulatory prudence that markets shall always be designed in a non-discriminatory manner and not rely upon assumptions about the possible impact of new market participants

2.Partial compensation

Partial compensation comes in many forms and gives a wide range of options. For instance, BRPs could be compensated at only 80-50% of the spot market price. However, finding the optimal compensation level is a difficult task and would requires an in-depth economic analysis.

Partial compensation would incentivize BRPs to predict the behavior of BSP-IAs to incorporate this into their modelling for their final position. If this is used as an input for modelling the baseline for calculating flexibility (as discussed in Part 4), then the payment to BSP-IAs for their demand-flexibly will be reduced as BRPs get better at predicting the behavior of BSP-IAs. This 'cannibalizing effect' would need to be avoided through work on the baseline for measuring flexibility. We discuss this more in Part 4.

Additionally, we fear that this option may lead to windfall profits for BSP-IAs in the DA-market as it may enable them to submit cheaper bids for flexibility than for energy when suppliers are essentially covering parts of their marginal costs.

Given the significance of the level of compensation on all markets, ministries will need to weigh the risks imposed by compensation on the demand-side response markets, against the risks to competition of insufficient compensation.

3.Full compensation

Full compensation, for instance set at the spot price for the relevant unmatched energy, to the BRP for the losses would remove the negative impact of BSP actions on BRPs. If BSP-IAs paid this directly, they would be internalizing the costs of their actions on other market participants, and so it can be seen to follow the polluter-pays principle.

However, it requires a clear distinction between imbalances directly caused by suppliers and unmatched positions caused by IAs. This is also in line with the principle of non-discrimination. To be able to make this distinction, it will be necessary to have access to very accurately metered values (see Part 4).

Having said this, it is also clear that overcompensation to suppliers must be avoided in any model as this may render aggregation futile from an economic perspective.

However, full compensation may have a negative impact on the business case for IAs in the balancing markets. There is a risk that if the business model is too weak to allow aggregation to take place at all, then in practice, aggregation will simply not happen. This will need to be weighed against the distorting effects that a lack of full compensation would have on the markets.

Who should pay for compensation?

It should also be noted that compensation may not necessarily be paid by IAs. The Directive does not prohibit Member States from supporting the role of IAs and thus they may choose to socialize compensation costs through tariffs.

Placing the costs of compensation on IAs will clearly weaken the business model for aggregation as it is likely to introduce significant costs for aggregators. Furthermore, Article 17.4 of the Directive states that the compensation for such unmatched positions '*shall not create a barrier to market entry for market participants engaged in aggregation or a barrier to flexibility'*. The Directive does not prohibit Member States from supporting the role of IAs and thus they may choose to socialize compensation costs through tariffs.

However, NordREG sees risks in this solution as the costs of compensating for aggregation would not be automatically weighed against the market value that aggregation is providing. The BSP-IA would no longer be internalizing the costs they cause to unmatched bids. There is a risk that such a mechanism would lead to overall higher costs for consumers, and mean that benefits of aggregation could be outweighed by its costs in compensating suppliers.

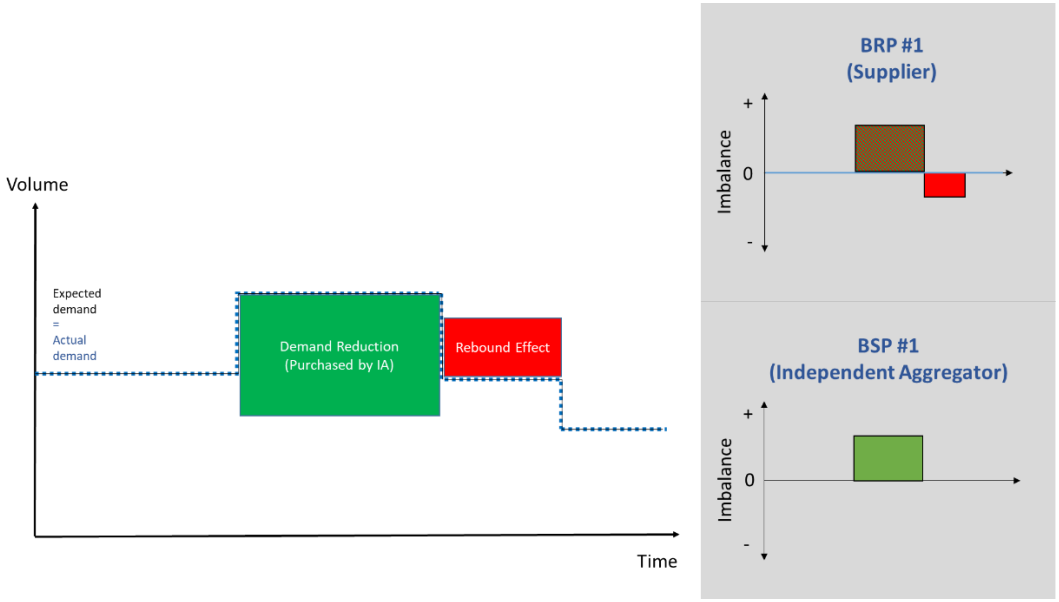
What is clear, and in line with the Directive which requires that compensation can only be paid by aggregators to the extent that '*the benefits to all suppliers, customers and their balance responsible parties do not exceed the direct costs incurred'*, is that a quantitative socio-economic analysis on models of compensation should be performed. This should be the basis for any decision on compensation mechanisms.

Further dimensions for compensation

There are two remaining dimensions that may be considered when developing a compensation mechanism: the accuracy of the mechanism and the treatment of rebound effects.

The former relates to the question whether compensation should be based on accurate load volumes, estimates or predefined mean values. In this context, the underlying dilemma is that IAs sell aggregated volumes, whilst the settlement process requires disaggregated volumes to correctly attribute costs.

If agreements between an BSP-IA and all its customers' BRPs for one BSP product are not possible, any new measurement requirements of flexibility resources will have significant impacts on all parties involved and so will need to be sufficiently accurate. Inaccuracies will cause market distortions, reducing the efficiency of resource allocation. This will be discussed in Part 4.



8: Rebound unmatched position from BSP actions

Finally, the rebound effect needs to be considered. As illustrated above, BSP-IAs ask customers to temporarily lower their demand and customers are likely to only postpone their demand in these periods. Due to this, they may consequently increase their demand in less constrained periods.

For instance, if the flexibility is derived from heating, there is a need to catch up by setting the heating to a higher setting for a while in order to maintain constant room temperature. This may create an additional unmatched position and thus cause imbalances for the customer's supplier in a different settlement period as demand would be higher than previously anticipated. There are currently no identified models which take these effects into account and which are able to reliably distinguish them from ordinary imbalances. NordREG may need to analyze the magnitude of these effects post implementation.

Compensation Recommendations

Immediate legislative changes

5: *National laws should allow the possibility for the relevant authorities to develop a coordinated methodology for compensation between market participants of unmatched BRP positions caused by BSPs*

Further work for implementation in the regulatory framework

G: *The relevant authorities should perform a full socio-economic analysis of compensation on the grounds outlined in the Directive before making critial decisions on the issue*

H: *The relevant Nordic authorities should together decide the level of compensation that should be granted, how this should be funded, and by whom. This should include specific definitions on whether compensation for capacity products that do not have a significant impact on energy imbalances could be disregarded*

I: *Relevant authorities should develop a methodology to implement such a system of compensation in practice*

4. Measurement of flexibility

Parts 2 and 3 argued that in all markets, there will be a need to separate the products delivered by an IAs from the rest of a consumer's consumption. This will be necessary in all models of aggregation in order for the TSO or BRP to assign the correct values for imbalances to the correct parties, as well as for making sure that the TSO will get the flexibility it purchases for balancing the system. Such a system of measuring an IAs flexibility needs to be resolved independently of the customer's existing supplier.

For flexibility to be traded and responsibility for imbalances to be accounted for, we need means for verifying that the flexibility took place, and a volume that is being corrected to the other BRP's imbalance. Two elements of measurement are necessary for the other regulatory aspects to work:

A. A 'baseline' of consumption for a flexible resource had flexibility not been delivered. That is, a mathematical model or an estimate of how much energy the resource would have used in the absence of an aggregator's action.
B. A measurement of real-time usage of the flexible resource, as distinct from the rest of a customer's load

Flexibility delivered is therefore simply the difference between the baseline and the metered real usage of the flexible resource. These two elements are addressed in the following two sections.

There are several ways to calculate these elements. NordREG believes that it is critical that an IA should be able to use a system of accounting for the actions that can be transferred between Nordic countries with minimal costs involved.

NordREG also recognizes a risk in having separate models for measuring the flexibility. The baseline, in fact, defines how much profit the aggregator is able to make. Unless the differing models estimate the baseline resulting in similar results, there will be differing profits in the different Member States regardless of providing a similar action. This could be considered to be discriminatory treatment of market participants, and thus against the CEP requirements.

(A) Baseline measurement

Establishing the baseline is challenging, as it requires estimating how a customer would have behaved if there was no demand response. Some models have proposed that aggregators, that have taken over direct control of their customers' loads, could be relied upon to submit an accurate baseline from metering data in their bids. This could however cause serious conflicts of interest.

Others have proposed to use historical regression or deterministic models based on final positions from suppliers. However, these models may have drawbacks over the long-run if the final positions of suppliers are used as input variables. If suppliers are expected to estimate and include the actions of aggregators in their demand estimates, suppliers' final positions will start to incorporate demand

flexibility and therefore will no longer be a reliable indication of what consumers would have consumed, had no flexibility been delivered[11].

A simpler form of baseline could also be defined as the exact level of consumption right before the flexibility event. This kind of a static baseline would imply that the customer would have used energy exactly at the same level, and would most likely be suitable for very short time periods of flexibility.

The issue of finding a robust approach to a baseline will present a number of issues that need to be resolved in the coming months.

System operators are responsible for establishing the rules by which this baseline is calculated and will need to coordinate their efforts. It is important that the interface for IAs is harmonized across the region, even if slightly different approaches to baselines are used. That is, IAs in one country should not be required to change their business model because of differences in baseline requirements if they begin to operate in another Nordic country.

(B) How to measure real-time consumption of flexible resources

The second element necessary for measuring flexibility is measuring the consumption of the flexible resource in real-time. This needs to be distinguished from the rest of a household's consumption following the arguments in the previous 2 parts.

If aggregators are able to come to a commercial agreement on balance responsibility with a customer's existing BRP, then such an agreement will include how the consumption at the flexible resource is metered or estimated. However, if an IA opts to split the balance responsibility for one customer, in either the commodity markets, balancing markets, or both, then it must be possible to distinguish between the metered responsibilities of each BRP and BSP for the same customer. Thus, a default solution needs to be available for when a contractual agreement between an IA and a customer's existing supplier or their BRP is not in place.

The customer's consumption volumes used for imbalance settlement or compensation can either:

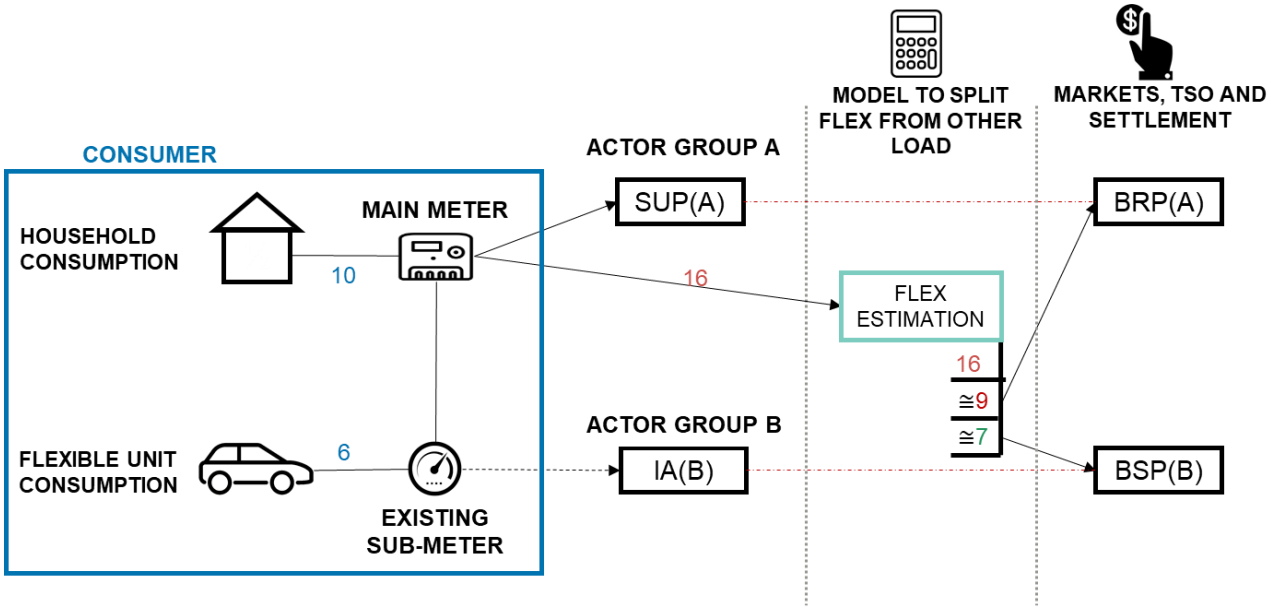
a) **Single-meter model:** use one data variable for the whole household's consumption, and then use a mathematical model to split this data after its submitted. This is what we have today in practice, where there is only one consumption input submitted by the DSO-owned smart-meter.
Or

b) **Sub-metered model:** two (or more) separate metered data variables, one for the household's normal consumption and one for the new flexible unit(s).

[11] Such a system would allow better supplier modeling to harm the income stream of IAs, cannibalizing the system benefits it has caused and leading to a return to low demand response for energy products in the long-run

a) Single-meter model

As shown in figure 9, an implicitly stated flexible resource consumption in model a) would require some form of estimation and allocation of imbalance responsibilities between parties. The main metered input value (here 16) would then need to be split using a model that can allocate the single metered value between the two parties (here, BRP(A) and BSP(B)).



9: One-meter implicit solution

Notably, IA(B) in figure 9 still has a meter attached to the flexible unit in order to provide its aggregation services. However, this data is not used in the one-meter implicit solution to calculate how much load the flexible unit provided.

This may well be possible under a commercial contract without using the metering data from the flexible resource if both parties can agree. However, NordREG believe that given the inaccuracy of such modelling and the potential for disputes between the two contracting competitors, this is not a plausible fallback solution if the actors cannot agree on a commercial contract. The same arguments discussed in Part 2 on organizing responsibilities for imbalances between BRP-IAs and BRP-suppliers apply here.

The system operator could be responsible for distinguishing the estimates of flexibility from the rest of the customer's demand profile. It is essential that such modeling would be sufficiently accurate for the market to work efficiently. Estimates that are biased too favorably to one party will cause inefficient market distortions.

This will be significantly more challenging due to the data not being split originally. The modeling involved would be highly complex, as it would involve estimating different levels of flexible consumption across consumers for different bid objects connected to different combinations of metered data across different BSPs and BRPs. It is questionable whether such modeling would provide consistent results or be cost reflective.

However, at this stage NordREG cannot rule them out without a quantitative assessment of the socio-economic costs of such models against the costs of explicit metering. Such a quantitative analysis also needs to assess whether a distinction should be made between small ordinary consumers vis-à-vis medium-sized and large consumers regarding metering requirements. As the loads of the former group are relatively low, there may be a trade-off between metering accuracy and increased system costs.

b) Sub-metering model

An explicitly stated flexible resource consumption (b) would, separate the consumption data for a household through using the additional metering data from the 'sub-meter' on the flexibility resource, removing the need for complex estimation models. The data would be metered and so less inclined to the biases and computation challenges of the implicit estimation models above.

Currently, in the Nordic countries it is the DSO that installs and owns the smart meters for the customer's connection point. The DSO is responsible for metering and validating all consumption/production data used in the settlement of the market actors and the customer.

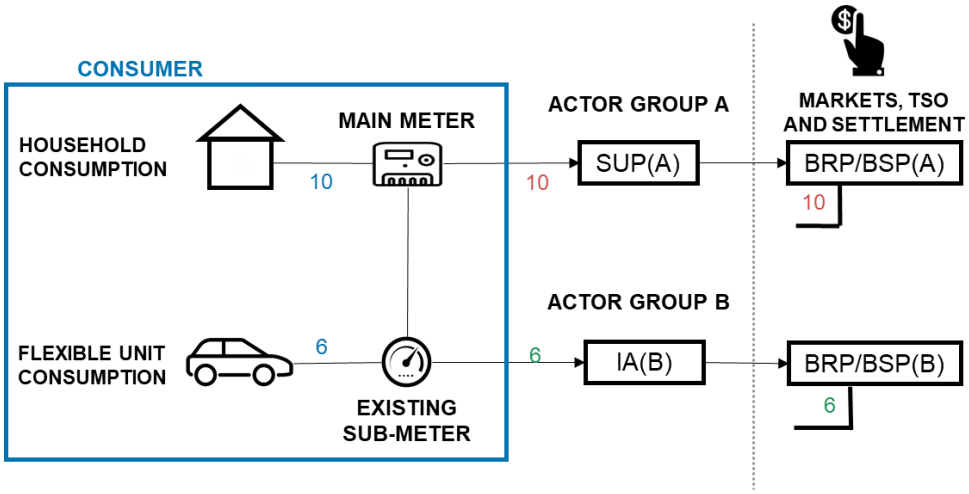
Whilst metering infrastructure appears to exist today for most aggregated flexible resources (e.g. EV charging points), it is largely not used for settlement and validation of consumption. It needs to be assessed whether this existing infrastructure can be used as 'sub-meters' and thus help to significantly reduce the implementation costs for independent aggregation.

Addition or replacement of DSO-meters

The problem regarding metering could theoretically be solved by installing new DSO-meters or installing a second DSO-meter. For DSOs to install additional new fully functioning smart-meters for each customer requesting a contract with an IA would however be extremely costly. It could pose a barrier to market entry, and it would likely remove reduce the welfare gains that independent aggregation could potentially bring. NordREG does not believe this would be a cost-effective solution.

Sub-metering

Allowing smart meter data on the meter attached to each aggregated flexible unit to contribute separate data to the various processes for settling balancing responsibility could potentially be a simpler solution for the challenge of metering flexibility. As figure 10 shows, this simply means that the data from the already installed smart meter on the flexible resource is submitted directly to the settlement process without the need for intermediate stage of estimation.



10: Sub-meter explicit solution

Under this approach, the 'sub-meter' on the flexible resource could either transmit the data to the customer's existing smart-meter allowing the smart meter to send two distinguishable sets of data to the relevant parties where the functionality exists. An another solution would be that the 'sub-meter' could submit its consumption usage directly to the relevant parties or via the aggregator for balance settlement, allowing the relevant parties to subtract the flexible resources consumption from the rest of a customer's consumption.

The critical element in all sub-metering approaches is that the data from a flexible resource's sub-meter could be used for the various requirements to provide accurate data outlined in Parts 2 and 3.

The consumption of flexible resource in most instances is metered by the aggregator. If an aggregator has the ability to control the consumption of the flexibility resource, or check that the consumer is doing what they said, then the consumption on the flexible resource needs to be metered. What this means, in practice, is that the sub-meters required for offering and metering the consumption of a specific flexible unit should be installed and paid by the aggregators

Such an approach would also internalize the costs of measuring real-time usage of flexibility resources. Thus, a potential cost of independent aggregation would be justifiably internalized by the IAs themselves, be factored into the pricing of aggregation services, and remove economic distortions. By internalizing the costs of measurement on the IA, the IAs would also have the right incentives to ensure that the measurement was performed in the most cost-efficient way, bringing down costs even further. In short, it would mean that the market would ensure that the benefits of aggregation must outweigh its costs.

This approach is being piloted by Energinet. Such an approach will require further work to make it workable across Norden.

Before using the aggregator's sub-meters to measure the consumption of the flexible unit, the overall system costs of altering the relevant IT infrastructure, such as Data Hubs, would have to be assessed and weighed against the benefits of such an approach. Given that these costs would fall

primarily on TSOs, NRAs should be involved in ensuring any costs incurred are reasonable and proportionate.

In addition, a cost-benefit analysis should assess whether a distinction needs to be made between small ordinary consumers vis-à-vis medium-sized and large consumers in regard to metering requirements. As the loads of the former group are relatively low, there may be a trade-off between metering accuracy and increased system costs.

However, we believe measurement of the flexible load will, at least, be required for consumers with significant loads as their potential impact on markets is more significant. In order to minimize the barriers for IAs across the region, we also need to ensure that our approach on the measurement of flexibility load remains consistent and delivers a clear and transparent fallback solution for those instances where a customer's IA and supplier have not agreed alternative arrangements.

Flexibility Measurement Recommendations

Immediate legislative changes

6: *Legal amendments on metering requirements for connection points with aggregation, subject to a cost-benefit analysis and technical feasibility.*

The cost-benefit analysis should take into account the expected cost savings when using existing metering infrastructure, an estimation of the overall system costs of altering the relevant IT infrastructure and an assessment whether a distinction needs to be made between consumers with smaller and larger loads in regard to metering requirements.

TSOs should be mandated to propose the required changes to settlement and metering requirements that would enable the use of an additional meter per connection point in the most economically efficient manner that is technically feasible. NRAs should approve such changes

Further work for implementation in the regulatory framework

J: *TSOs should develop a coordinated approach and methodology for calculating baselines to check the delivery of flexibility. NRAs should approve this coordinated approach*

Such solutions should ensure they continue to allow demand response for the benefit of the energy system, without causing significant market distortions.

K: *TSOs should work together with NRAs to identify the changes required to allow for different reliable approaches for measuring the actions of IAs, and accounting for this in the settlement process. This should include at least proportionate and relevant metering requirements.*

NRAs will assess the issue of sub-meter ownership, and propose regulatory changes on the basis of this assessment. This work should be aligned with work on the Nordic data hubs

Conclusions and Recommendations

Aggregation shows great potential for enabling a more efficient and sustainable energy system. It can empower consumers to engage and benefit from trading in electricity markets, encourage innovation in electricity trading, and enable wide-scale and localized flexibility to help accommodate new demand and renewable generation. In short, aggregation could prove to be a key enabler of the green and consumer-led energy transition.

The Clean Energy Package paves the way for aggregation through removing market barriers and giving new rights and opportunities to customers in how they contract aggregation services by allowing aggregators to operate independently of suppliers.

NordREG supports this intention and believes a prudent transposition and implementation of the Directive could enable significant and positive changes for how electricity is managed in Norden. By opening up the market to independent aggregation, we can allow innovations and economies of scope from other sectors, and allow for a smarter market-driven approach to managing the power system.

The main challenge is to strike a balance between preserving the advantages of our current market set-up and opening up the playing field to innovations in aggregation.

Due to the nature of the common Nordic electricity markets, the NordREG consider it necessary for the legislators to work together when designing the required changes. To unlock the benefits of aggregation, the market structure needs to be sufficiently coherent over the entire market. The NordREG hope this commonly agreed document can serve as the basis for such discussions.

By the same token, NordREG believe all Nordic system operators (that is, TSOs and DSOs) will need to work closely together in order to facilitate a more harmonized approach to how the Directive and the Electricity Balancing Regulation are implemented.

This is in line with the priorities agreed by Nordic Electricity Forum and the Nordic Council of Ministers' Electricity Markets Group in 2019[12]. Thus, as an overarching approach to implementation, NordREG recommends that:

> ***1:*** *Legislation should grant NRAs the authority to require system operators to implement a coordinated approach to independent aggregation across the Nordic market.*

In terms of other areas requiring further work and immediate attention, we recommend that:

> ***A****: Nordic ministries should work together to develop a road map and the agreed principles for the relevant authorities to implement their work in a coordinated manner across the region. The road-map should be built on the initial experiences in aggregation and include explicit deadlines for harmonization on all parties involved*

[12] https://nordicelforum.org/wordpress/wp-content/uploads/2019/06/Handlingsplan-for-at-opn%C3%A5-2030-visionen-FINAL.pdf ; https://nordicelforum.org/forum-presentations-outcomes/

As described in Part 1, the Directive requires the outcome to be beneficial to the end-users. Thus, NordREG recommend that all parties involved in implementation consider the total effect that the regulatory changes will have on the market and its end-users. The Directive aims at bringing benefits to the entire system. Enabling independent aggregators using a scheme which does not bring benefits, only for the sake of enabling aggregation, seems counterproductive and against the intention of the CEP.

With this in mind, we would propose the following more detailed changes to legislation or areas for improving the regulatory framework. Note, in recognition of the different institutional arrangements in each Nordic country, ministries will need to decide which 'relevant authority' should be responsible for each of the recommended areas for work.

Market Access

As outlined in Part 1, an efficient and fair regulatory framework needs to be in place to enable independent aggregators to access the markets. In this regard, the rights of aggregators need to be implemented into national law and balanced with the obligations of being a market participant.

With this in mind, for legislative changes we recommend:

> ***2:*** *Electricity consumer protection legislation should be reviewed to ensure that suppliers cannot introduce undue costs on their customers if their customers choose to contract with an aggregator*
>
> ***3****: Legislation should require system operators to agree to a more harmonized approach to pre-qualification to provide a level playing field for aggregators within a specified time*

If ministries approve NordREG's approach, we recommend the following areas for further work on concret proposals for harmonized regulatory adjustments:

> ***B:*** *The relevant authorities should assess whether there is a need for data exchange between electricity undertakings servicing the same customer for the efficient operation of the market, and if so, what these requirements should be*
>
> ***C:*** *System operators should propose and the NRAs should approve a road-map and clear deliverables on harmonisation of pre-qualification requirements to remove barriers to aggregators operating between countries in the region*
>
> ***D****: Once the regulatory framework for independent aggregation is in place, NRAs and system operators should review the development of local flexibility markets to ensure independent aggregators are not facing undue barriers*

Imbalance responsibility

As Part 2 argued, clarifying balance responsibilities for IAs should allow effective independent aggregation, while minimising unfair distortions in the market.

With this in mind, for immediate legislative changes we recommend:

> ***4:*** *Market participants, including aggregators, should have the right to split the financial responsibility for a customer's energy imbalances at a single connection point, as long as:*
> *1) they have the consent of the customer to do so*
> *2) it is technically feasible, and*
> *3) the costs of allowing such split are proportionate to the benefits*
>
> *In practice, this would mean that market participants are able to request that more than one market actor can be a BRP for the same DSO-metered connection point if adequat metering is cost-effective and in place.*
>
> *The approach to this should be coordinated as far as possible accross the region to enable the most efficient economies of scope and scale*

For areas needing further work to harmonize the regulatory framework:

> ***E*****:** *The relevant authorities should aim at a close harmonisation of the requirements on BSPs and their relationship to BRPs under the implementation of the Electricity Balancing Guideline, and take into account the principles outlined in this paper*
>
> ***F:*** *The relevant authorities should clarify the requirements on BRP-IAs operating in the energy commodity markets, enabling them to operate on an equal footing to traditional suppliers subject to technical requirements. This should take into account NordREG's recommendation on not allowing IAs to use consumption volumes to place negative production bids*

Compensation

As part 3 discusses, compensation of unmatched BRP positions caused by BSP-IAs needs to be assessed and resolved by the relevant authorities. Any solution will involve a significant reallocation of resources between market participants and poses risks. The costs of such reallocations *must* not outweigh the benefits that aggregation brings to customers and the system.

Given the redistribution any choice on the matter will have between market participants, governments will need to decide on the case for compensation.

With this in mind, for immediate legislative changes to ensure time to properly assess the issues at hand, we recommend:

> ***5:*** *National laws should allow the possibility for the relevant authorities to develop a coordinated methodology for compensation between market participants of unmatched BRP positions caused by BSPs*

For areas needing further work:

G: *The relevant authorities should perform a full socio-economic analysis of compensation on the grounds outlined in the Directive before making critial decisions on the issue*

H: *The relevant Nordic authorities should together decide the level of compensation that should be granted, how this should be funded, and by whom. This should include specific definitions on whether compensation for capacity products that do not have a significant impact on energy imbalances could be disregarded*

I: *Relevant authorities should develop a methodology to implement such a system of compensation in practice*

Measurement

The fair measurement of flexibility underlies all the above recommendations. It must be possible for market actors to resolve the issue of measurement commercially to satisfactory standards, or to have a fall-back if aggreement is not reached which maintains the fairness of the markets.

In essence, the regulation for measuring flexibility should allow an aggregator in one Nordic country to deploy their technical solutions in another Nordic country, without facing significant barriers to doing so.

With this in mind, for immediate legislative changes we recommend:

6: *Legal amendments on metering requirements for connection points with aggregation, subject to a cost-benefit analysis and technical feasibility.*

The cost-benefit analysis should take into account the expected cost savings when using existing metering infrastructure, an estimation of the overall system costs of altering the relevant IT infrastructure and an assessment whether a distinction needs to be made between consumers with smaller and larger loads in regard to metering requirements.

TSOs should be mandated to propose the required changes to settlement and metering requirements that would enable the use of an additional meter per connection point in the most economically efficient manner that is technically feasible. NRAs should approve such changes

For areas needing further work:

J: *TSOs should develop a coordinated approach and methodology for calculating baselines to check the delivery of flexibility. NRAs should approve this coordinated approach*

Such solutions should ensure they continue to allow demand response for the benefit of the energy system, without causing significant market distortions.

K: *TSOs should work together with NRAs to identify the changes required to allow for different reliable approaches for measuring the actions of IAs, and accounting for this in the*

settlement process. This should include at least proportionate and relevant metering requirements.

NRAs will assess the issue of sub-meter ownership, and propose regulatory changes on the basis of this assessment. This work should be aligned with work on the Nordic data hubs

Next Steps

NordREG recommends that in close coordination, ministries take the 6 recommendations for legislative changes into account, in order to enable the legal basis for a common Nordic market for aggregation services.

Once the ministries have agreed the principles for independent aggregation, NordREG recommends that NRAs and system operators start working with stakeholder on the areas for further work needed to harmonize implementation.

In line with the Directive's requirements, this work will need to be sufficiently progressed to allow for independent aggregators to start entering the market.

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