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Engaging Small-Load Flexibility-Service Providers (SL-FSP) in electricity markets: A Value-Incentivising Framework for active customers participation and aggregator business model viability

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Madrid, Spain; November 7, 2023

Dr. Aoife Foley
Managing Executive Editor - Renewable and Sustainable Energy Reviews Journal
Subject: Submission of Manuscript

Dear Dr. Aoife Foley,

We are pleased to submit our manuscript entitled "Engaging Small-Load Flexibility-Service Providers (SL-FSP) in Electricity Markets: A Value-Incentivising Framework for Active Customers' Participation and Aggregator Business Model Viability" for consideration in "Renewable and Sustainable Energy Reviews." This paper is a collaborative effort between me, Valeria Karina Moreno, Carmen Valor Martínez, and José Pablo Chaves Ávila.

In this pioneering study, our paper illuminates the pivotal role of small-load flexibility-service providers (SL-FSPs) within the evolving landscape of the power system, with a keen focus on integrating renewable and sustainable energy resources. We are proud to present the first comprehensive framework meticulously designed to catalyse the engagement of active customers—a cornerstone for the success of aggregator business models in harmony with sustainable energy mandates. This groundbreaking framework is the first of its kind to offer a holistic analysis of the entire spectrum of incentives available for SL-FSPs, setting a precedent for future research and practical applications in the field. Our manuscript not only fills a crucial gap in current academic discourse but also offers invaluable insights for industry practitioners, potentially steering the direction of policy and commercial strategies towards a more resilient and sustainable energy future.

The methodology and review process embedded in our study encompass an expansive database of approximately 500 programs, from which 60 relevant studies were meticulously analysed. Consequently, our manuscript fits the criteria of a 'Review Article' and comprises 7,824 words, excluding the references. Moreover, we have undertaken diligent efforts to ensure that the manuscript adheres to the highest standards of academic excellence and rigour.

We propose as potential reviewers for our manuscript esteemed academics with significant expertise in the field. Dr Benjamin K. Sovacool, Professor of Energy Policy at the Science Policy Research Unit (SPRU) at the University of Sussex Business School in the United Kingdom, whose extensive research on energy policy renders him an authoritative figure pertinent to our paper's domain. Dr José Villar, a senior researcher at the Centre for Energy Systems of INESC TEC, overseeing the Electricity Markets area since 2017, whose profound engagement with energy markets and systems analysis aligns with our study's subject matter. Dr Özge Okur, an Assistant Professor in the Systems Engineering section at the Faculty of Technology, Policy, and Management at Delft University of Technology, whose expertise in systems engineering and sustainable energy systems offers a comprehensive perspective beneficial for reviewing our work.

Given the mission of "Renewable and Sustainable Energy Reviews" to communicate innovative and critical thinking in the field, we believe our research aligns perfectly with the journal's aim and would be of significant interest to its readership. The paper not only contributes to academic discourse but also provides practical insights that can assist policy and decision-makers, as well as the research community, in the transition to a low-carbon future.

We also declare that we have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This material is the authors' own original work, which has not been previously published elsewhere, and it is not currently being considered for publication elsewhere. The paper reflects the author's research and analysis truthfully and completely.

We eagerly await your response and hope our manuscript will be deemed a worthy contribution to the esteemed journal. We appreciate your consideration and look forward to the opportunity to contribute to the critical discussions surrounding renewable and sustainable energy resources.

Warm regards,



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Engaging Small-Load Flexibility-Service Providers in electricity markets: A Value-Incentivising Framework for active customers participation and aggregator business model viability

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Abstract - Integrating renewable energy sources (RES) into electricity systems is crucial for achieving a sustainable, low-carbon future. However, the intermittent and variable nature of renewable power generation poses challenges that require increased flexibility in the electricity system. Flexibility programmes, particularly incentive-based or explicit flexibility, are vital in addressing this challenge. These encourage energy flexibilisation in return for compensation so that customer flexibility is sold in electricity markets either directly or through aggregators. By bundling flexibility from individual customers, aggregators enable seamless incorporation into the system, supporting the effective utilisation of renewable energy sources. Recent research indicates a limited willingness among small-load flexibility-service providers (SL-FSPs), such as residential customers, to actively participate in providing flexibility services, primarily due to a perceived lack of value associated with their involvement. This undermines the assumption that customers are passive price takers and threatens the feasibility of flexibility services and business models. To tackle this issue, this paper proposes a comprehensive value-incentivising framework based on an extensive review of existing flexibility programmes in the United States. The framework guides the design of incentivising strategies to effectively engage SL-FSPs in flexibility markets, considering the restrictions established by the DSO/TSO. The two-layered incentive framework integrates five components that together foster SL-FSP participation, meet DSO/TSO requirements, and ensure the viability of the aggregator's business model. The findings and recommendations presented in this paper offer valuable insights for policymakers, market operators, and stakeholders, promoting active customer engagement and enabling the successful integration of renewable energy sources in electricity systems.

Highlights:

- The two-layer, five-component framework boosts SL-FSP engagement.
- Harmonized incentives align aggregator, customer, and DSO/TSO needs.
- Framework provides a strategic blueprint for effective incentive categorisation.

Keywords: Incentive-based flexibility, Explicit Flexibility, Demand-response programmes, Aggregator, Value-Incentivising framework

Word Count: 7,906 words, excluding the references

List of abbreviations:

DR: Demand Response
DRP: Demand-Response Programmes
DSO: Distribution System Operator
EV: Electric Vehicle
FSL: Firm Service Level
FSP: Flexibility-Service Provider
GV: Generated Value
HL: High Load
HL-FSP: High-Load Flexibility-Service Providers
IB FP: Incentive-Based Flexibility Programmes
NGO: Non-Governmental Organization
NREL: National Renewable Energy Laboratory
PB FP: Price-Based Flexibility Programmes
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PV: Perceived Value
RES: Renewable Energy Sources
SL: Small Load
SL-FSP: Small-Load Flexibility-Service Providers
SO: System Operator (either TSO or DSO)
TOU: Time-of-Use
TSO: Transmission System Operator

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1. Introduction

The deployment of renewable energy sources (RES) in electricity systems has created a growing demand for flexibility services [1] to ensure real-time matching of energy supply and demand [2], [3]. It is essential to clarify that the flexibility services under consideration are the SO services, which refer to the market-based procurement of balancing, voltage control, and congestion management [4]. Both supply-side and demand-side management offer various flexibility options [5]. While thermal power plants and hydropower contribute to supply-side management [6], demand-response programs (DRP) do it from the demand-side [7]. The rise of distributed energy resources has enabled customers to control their generation and demand, increasing energy flexibility capacity [1]. To facilitate the participation of individual customers in electricity markets, aggregators have emerged as key players who consolidate and trade flexibility derived from pooled customer assets [3], at least until automation and regulation enable automatic participation through smart energy management systems [8].

Demand-response programs (DRP), a form of flexibility provision, involve customers deliberately adjusting their consumption patterns in response to different incentives [9], [10]. This adjustment can include shifting appliance usage to cheaper or more abundant electricity periods or utilising on-site generation, such as solar panels, to reduce grid dependency [11]. Customers can provide flexibility to the electricity system by voluntarily adjusting their electricity consumption based on these signals, manually or automatically [12]. DRPs can be classified into implicit or price-based flexibility and explicit or incentive-based flexibility [13]. Implicit flexibility refers to customers adjusting their consumption based on time-varying electricity prices [14]. Examples include time-of-use, critical peak, and real-time pricing [15]. In contrast, explicit demand response is an incentive-based system that encourages energy flexibilisation in return for compensation so that customer flexibility is sold in electricity markets either directly or through aggregators [16]. This paper focuses on explicit flexibility provision.

Aggregators play a critical role in establishing flexibility markets [17] and have become essential actors in the energy sector. They represent customers [18] and empower them by offering financial incentives, allowing them to earn money through participation [19]. Customers' portfolios play a crucial role in the success of aggregators' business models [3]. By bundling flexibility from individual customers, aggregators enable seamless incorporation into the system, supporting the effective utilisation of renewable energy sources [3]. The business model of aggregators is based on negotiated favourable terms and conditions with market participants (DSO/TSO) and ensuring equitable compensation for the flexibility services provided by customers [3]. Incentive-based programs not only enhance aggregators' control over energy resources but also give them a competitive edge. Aggregators are expected to prioritize incentive-based programs in their future strategies increasingly. However, to thrive, aggregators need to attract a diverse and reliable pool of customers capable of providing flexibility as required, ensuring stability and risk management.

Small-load flexibility-service providers (SL-FSPs), primarily consisting of residential customers with a capacity of approximately 10kW or less, play a crucial role in enabling flexibility resources. These providers are expected to modify their power consumption or generation in response to grid signals, manually or automatically, based on user preferences and specific service requirements [20]. However, despite their fundamental role, SL-FSPs are reluctant to participate in flexibility provision actively [21], [22]. While they recognise the benefits of flexibility provision for the system, they anticipate significant costs and do not see sufficient benefits [21], [23].

This perceived lack of value and anticipated costs hinder their active engagement in explicit flexibility programs[21]. Specific challenges SL-FSPs face include changing consumption habits, concerns about reduced comfort, and a limited understanding of flexibility provision requirements [24]. The difficulties in modifying practices such as laundry or dishwashing further complicate the provision of flexibility services [24]–[26]. Moreover, this rigidity could explain why, whilst most scholarly investigations suggest that domestic consumers react to fluctuating electricity tariffs, an in-depth examination conducted by Reise and White highlights that a substantial segment of households remain unresponsive to price variations [27]. Compensating customers for their flexibility may be a more promising strategy for ensuring their participation. Despite the importance of this incentivising model to entice customers to engage in flexibility provision and to ensure the viability of the aggregator business model, we lack a systematic and integrated model of incentives or compensation [28].

This paper outlines a value-incentivising framework for flexibility provision that balances the objectives of both aggregators and SL-FSPs so that it offers enough incentives for the participation of SL-FSPs while ensuring the economic feasibility of the aggregator business model [3]. The framework considers the business model's financial aspects, such as profitability and gains, and operational aspects, such as asset management optimisation, to establish an incentivising model aligned with the perceived value from the customer's viewpoint [29]. By adopting a customer-centric approach, the model encourages customer participation in flexibility markets and supports the sustainability of aggregating flexibility provision from small customers, meeting the requirements established by the DSO/TSO.

To develop the model, an inductive critical analysis of existing flexibility projects in the US [30] was conducted. The projects were reviewed to identify the components of the incentivising model and to assess them against the principles established in the foundations critically. This critical review is the basis for proposing a comprehensive and structured incentivising model. The model explains how each component meets the goals outlined in the foundations.

This research contributes to the literature on demand-response services and business models by providing an integrated yet parsimonious model that can guide practitioners in designing effective strategies to engage SL-FSPs in electricity markets. By prioritising customer value creation, the model aims to ensure active customer participation in flexibility markets, thereby enhancing the stability and efficiency of the entire system. Moreover, the model ensures the viability of aggregators as key players in the evolving energy sector.

The manuscript is structured as follows. First, it establishes the foundations by outlining the needs of both aggregators and consumers, emphasising the interdependence between the two and the requirements of the DSO/TSO. Second, a review of existing US flexibility projects informs the definition of the model's components, aligned with the principles established in the foundations. Third, these components are integrated into a comprehensive framework that provides an incentivising structure to drive the active engagement of SL-FSPs in flexibility provision and, simultaneously, ensures the sustainability and effectiveness of aggregator business models. Finally, the contribution of the model is described.

2. A foundational framework for an incentivising model

The Value-Incentivising Framework aims to strike a balance between aggregator goals and end-customer needs, recognising that customer participation is vital for the viability of the aggregator business model [3]. However, it is important to acknowledge that this framework primarily focuses on addressing key aspects of value and incentives and does not explicitly encompass the technical and regulatory considerations essential for the successful implementation of aggregator business models, as these intricacies have been subject to in-depth analysis in other research [3], [31]–[33]. The aggregator serves as an intermediary between the requirements of the DSO/TSO and the needs of the end customers [32]. The aggregator must comply with the demands and technical specifications stipulated by the DSO/TSO for the flexibility requested [3]; to comply with these requests, they need to onboard several users able and willing to provide flexibility with these technical specifications. Although this paper does not extensively explore the specific needs of the DSO/TSO, it is crucial to consider the fundamental technical specifications as they will modulate the actual incentives that aggregators can offer to customers.

Four fundamental conditions are proposed for enabling the viability of aggregator business models: critical mass, reliability, loyalty, and versatility. The viability of these models hinges primarily on attracting a sufficient number of customers [34]. The attainment of a "critical mass" is crucial as it provides the necessary scale and volume to leverage flexibility in energy markets [35]. A larger customer base allows aggregators to pool substantial assets, facilitating effective participation in electricity markets and creating a diversified portfolio that enhances the resilience and robustness of the business model. Additionally, achieving a critical mass enables economies of scale, optimising operational and management costs [36]. Distributing fixed costs over a larger customer base, per-unit costs decrease, rendering the business model more economically viable. In summary, achieving a critical mass of customers is vital for the aggregator's business model to thrive by providing scale, diversity, and cost efficiencies that benefit both the aggregator and customers.

Customer versatility is another crucial consideration within the framework, emphasising the ability of customers to offer both power (kW) and energy (kWh) services [3]. The incentive model must promote both power provision and capacity to meet the diverse needs of aggregators. Neglecting either power or capacity provision compromises the ability to satisfy the demands of the aggregator and customers to provide flexibility services [32]. Third, reliability is a pivotal condition for implementing a successful business model [3]. It entails consistent and predictable customer engagement whenever their assets are needed for model operations. Reliable customer participation ensures aggregators achieve the expected results for the electricity system, thereby contributing to overall stability and functionality [31]. Through reliable engagement, aggregators can ensure that the services can be delivered as required by TSOs and DSOs.

Loyalty, the ongoing engagement of participating customers, is a fourth critical principle [37]. Aggregators must strive to maintain the loyalty of their customer base, particularly those customers with higher or more versatile capacity and greater reliability. Loyalty not only reduces acquisition costs but also enables aggregators to exploit the strategies and practices associated with energy flexibility fully. The continuous engagement of participating customers is paramount due to the substantial cost differential between acquiring new customers and retaining existing ones [38]. Research indicates that both acquisition and retention costs are crucial, but the consequences of underspending on retention are far more severe than for acquisition. Thus, while acquiring new customers is essential, retaining existing ones is paramount [39], [40]. Moreover, a significant portion of the aggregator's business model relies on customer data, which is valuable when customers remain engaged for extended periods [41]. Transient or flicking customers hinder the effective utilisation of data and its potential for modelling and leveraging for new services development [41], [42].

Related to this, gathering feedback is crucial in ensuring sustained customer participation even beyond the expiration of contractual obligations [32]. Obtaining feedback on program satisfaction, incentives, and mechanisms helps in understanding customer preferences, concerns, and satisfaction levels so that engagement strategies can be changed accordingly to ensure the creation of long-lasting relationships with flexibility providers [43]. This enables aggregators to make informed decisions, tailor future offerings, and address potential obstacles or areas for improvement, thereby increasing the likelihood of continued participation and business model success [41]. Additionally, multiple aggregators competing for customers with higher capacity or greater reliability underscores the importance of loyalty. Aggregators that can effectively retain their customer base and prevent customers from switching to competitors gain a significant advantage [3]. This advantage enables them to build trust, cultivate long-term relationships, and explore innovative strategies to enhance the overall feasibility and sustainability of their business models.

In sum, critical mass, versatility, reliability, and loyalty are fundamental conditions for the viability of the aggregator business model. Achieving a critical mass of customers enables scale, diversity, and cost efficiencies, enhancing the overall effectiveness of the business model [11]. Reliability ensures consistent and predictable customer engagement, contributing to system stability and reducing unexpected costs [28]. Customer versatility in offering power and energy services is crucial for meeting aggregators' capacity needs [12]. Loyalty reduces customer acquisition costs and facilitates the development of new services by aggregators [44]. An incentivising model that meets these four conditions will ensure that aggregators establish a solid foundation for their business models, promoting sustainability and fostering mutually beneficial outcomes for aggregators and customers.

Although the four components are fundamental for the sustainability of the aggregator business model, their importance can be differentiated across two distinct phases. In the initial phase, aggregators should prioritize achieving critical mass and ensuring versatility. These aspects lay the groundwork and facilitate them to forge contracts and roll out their services. As they evolve, aggregators will confront myriad challenges and unearth novel opportunities. In this matured stage of their business trajectory, when aggregators compete for the more valuable customers, reliability and loyalty become prominent, as having a reliable and loyal customer base will provide a competitive advantage in a competitive landscape.

As previously stated in this section, the Value-Incentivising Framework also aims to balance the goals of the aggregator and the customers (SL-FSP). Within this framework, customers' motivations and concerns are crucial in shaping the incentivising model. The two primary factors that come into play are gains or benefits and pains or costs [45]. The incentivising model should increase the gains and minimise the pains, effectively motivating

customers to participate in flexibility provision. Understanding the gains and pains of customers in flexibility provision services also provides foundational knowledge for articulating a value-incentivising framework.

First, the framework should align with customers' expected gains [45]. Engaging in flexibility provision is perceived as creating various gains for customers, categorised as self-centred and other-centred motivations. Self-centred gains revolve around financial benefits, often considered the primary driver [23]. Additionally, customers may seek identity gains, such as projecting an environmentally conscious image or gaining increased social status for being an early adopter [46]. Comfort, security, and other functional gains are also important considerations [23], [47]–[49].

Other-centred motivations encompass environmental and social gains. Environmental benefits, such as climate change mitigation, consistently emerge as a key motivation for participating in flexibility provision [23], [47]–[49]. Notwithstanding, these environmental benefits may not be immediately apparent to users [50]. Additionally, there are unexplored potential benefits, including community resilience, enhanced infrastructure, and resource sharing with less privileged households. Social factors, such as the desire to engage with neighbours, raising children's environmental awareness, increasing social resilience and self-sufficiency, and the aspiration to contribute to the reliability improvement of the electricity system, may also benefit customers [23], [51].

Despite the gains, customers anticipate certain costs or pains [45] for their flexibility provision, including perceived risks, inconveniences, uncertainties, and limitations [32], [52]. By addressing these pains and understanding customer difficulties, aggregators can create a more favourable environment for customer engagement. These costs, such as stress, time commitment, and potential loss of comfort, influence the overall incentivising decision [52]. Among the anticipated pains, changing habits, perception of reduced comfort, and limited understanding of flexibility provision are commonly mentioned considerations [23][23], [47]–[49]. Altering established routines poses challenges, with certain household practices proving more resistant to change than others [23]. Cultural norms surrounding food preparation and consumption, as observed in countries like Italy and France, contribute to the resistance to changing dinner times [48].

The perception of reduced comfort is also a significant concern, particularly regarding heating practices [23], [47]–[49]. Heating a home is often considered non-negotiable, and customers anticipate discomfort if flexibility provision compromises their desired temperature levels. Recognising this dynamic and implementing smart algorithms that maintain desired temperatures while optimising flexibility is crucial for customer comfort. Or provide enough incentivising for this hassle. While automated flexibility solutions present their merits, the presented paper accentuates the imperative of providing ample incentives to counterbalance perceived discomforts, ensuring that customers recognise and experience the intended value.

Limited understanding or misconceptions about flexibility provision present customer challenges [53]. The complexity of energy markets, coupled with past crises that have fostered mistrust, hinder customers' ability to comprehend and engage with flexibility provision. This lack of understanding can also lead to concerns about personal data usage [54]. The literature on demand response (DR) identifies additional challenges and barriers to adoption, including a lack of comprehension regarding DR and its system value, overall complexity, and inadequate market structures. [44]. When customers anticipate more costs than gains, their willingness to participate in flexibility provision is curtailed [23]. Therefore, the incentivising model should focus on increasing the perceived value by enhancing the anticipated gains and minimising the anticipated pains. Maintaining a favourable balance between gains and pains over time is essential to sustain customer engagement, and an incentivising strategy is instrumental for this [55], [56].

Finally, it is necessary to include the DSO/TSO demands in the framework. This aspect is referred to as "Response to the DSO/TSO" in the present paper. It entails a set of conditions that must be considered when applying the Value-Incentivising Framework. Understanding and accommodating the technical demands of the DSO/TSO will be instrumental in shaping the incentives and value propositions offered to end customers through the aggregator's services. Within this component, there is a granularity that relates the aggregator's business model to the technical characteristics that DSO/TSO may request [57]. The following factors can be considered as price modulators that enable compliance with the technical requirements of the DSO/TSO while adequately compensating consumers for the different perceived costs that the provision of these requirements entails. They are considered price

modulators because they affect the quantity or incentive paid rather than being a component alone, either amplifying or attenuating them. Table 1 shows these modulators, which can serve as essential tools for aggregators to align their offerings with the technical needs of the grid operators. By adjusting compensation based on these modulators, aggregators can incentivise customers to provide flexibility that meets the requirements set forth by the DSO/TSO. This approach enhances the overall compatibility of the aggregator's services with the electricity grid's technical demands, fostering a smoother integration of flexible resources into the system.

Table 1. Response to DSO/TSO

Service Characteristics	Definition	REF	Price modulator
Notice time (Advance Notice)	This advance notice empowers participants to plan and adjust their energy usage; for example, the notice time could be 1 day, 2 hours, 15 minutes, etc.	[55]	Negative: The greater the advance notice, the lesser the amount
Timeframe	Temporal specification within the event will occur during the summer or winter seasons, on weekdays or weekends, and at specific hours.	[55]	Negative: Defined timeframes offer fewer amounts
Frequency of activation (Number of notices or frequency)	The number of notices participants receive within a period, for example, a given month.	[55]	Positive: The greater the number of notices, the greater the amount
Preparation period	The period between the request by the SO and the start of the ramping period.	[54]	Positive: Longer preparation periods lead to greater amounts
Ramping period	The period during which the input and output of power will be increased or decreased until the requested amount is reached.	[54]	Positive: Longer ramping periods lead to greater amounts
Full activation time	The period between the activation request by the SO and the corresponding full delivery of the concerned product.	[54]	Positive: Longer activation times lead to a greater amount
Minimum/maximum quantity	The power (or change in power) which is offered, and which will be reached at the end of the full activation time.	[54]	Positive: Higher quantities or changes in power offer a greater amount
Minimum/maximum duration of delivery period	The minimum/maximum length of the delivery period during which the service provider delivers the full requested change of power in-feed to or the full requested change of withdrawals from the system.	[54]	Positive: Longer delivery periods lead to a greater amount
Deactivation period	The period for ramping from full delivery to a set point or from full withdrawal back to a set point.	[54]	Positive: Longer deactivation periods lead to a greater amount
Granularity	The smallest increment in volume of a bid.	[54]	Positive: Larger bid increments lead to greater amount
Validity period	The period when the bid offered by the FSP can be activated, where all the characteristics of the product are respected. It is defined by a start and end time.	[54]	Positive: Longer validity periods lead to a greater amount
Recovery period Minimum	Minimum duration between the end of the deactivation period and the following activation.	[54]	Positive: Longer recovery periods lead to a greater amount
Mode of activation	The mode of activation of bids, i.e., manual, or automatic. Automatic activation is done automatically during the validity period, whereas manual activation is done at the request of the SO.	[54]	Automatic activations offer a greater amount

In sum, the sustainable business model for the aggregator is situated at the confluence of the value they generate, and the value perceived by both the consumer and the DSO/TSO. Figure 1 illustrates the interplay between the aggregator, the DSO/TSO, and the customer, a relationship sculpted by previously discussed factors. As initially outlined, as the aggregator's business model progresses, it is essential to amplify the perceived value (PV) for both the customer and the DSO/TSO by generating value. For the customer, this perceived value (PV) arises from augmenting gains and mitigating pains. In contrast, for the DSO/TSO, it emerges when their stipulated requirements are met at the lowest possible cost. At the nexus of these relationships is the generated value (GV) by the aggregator. To realise this goal, they must deploy innovative mechanisms to generate value. How this value is produced is the central concern of this paper, which aims to delineate the Value-Incentivising Framework.

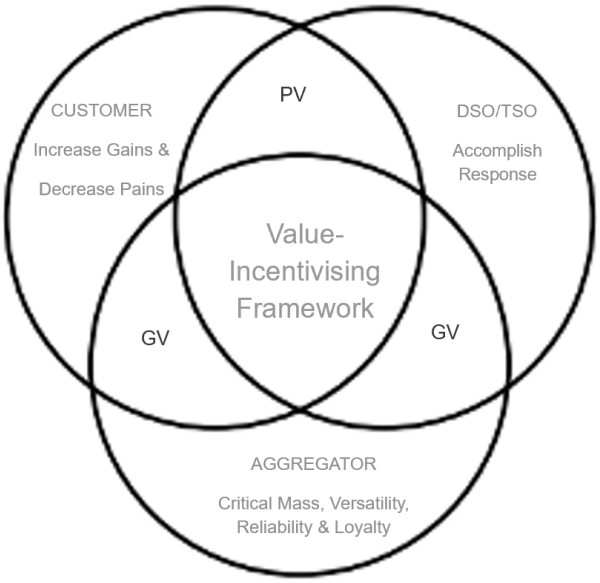


Figure 1. Aggregator, DSO/TSO, and Customer interaction in the Value-Incentivising Framework. PV= perceived value and GV= generated value

3. Method

This section delineates the methodology employed for this paper. The research approach combined a literature review with a project review. Initially, a foundational framework was crafted via a literature review, incorporating the principles outlined in Section 2. This process was executed via Scopus using the search string presented below:

TITLE-ABS-KEY (flexibility OR "demand response") AND (energy OR electricity) AND (pricing OR incentives) AND (motivations OR enablers OR barriers OR acceptance) AND (customer OR residential OR "end consumer") AND (aggregator OR "business model") AND (PUBYEAR > 2015 AND PUBYEAR < 2023) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")) AND (LIMIT-TO (LANGUAGE, "English"))

Given the existing literature's lack of clarity on the effective mechanisms for incentivisation, a project review was deemed necessary. This step was pivotal for validating the initial components identified from the literature and for integrating elements not explicitly elucidated or those that could be enhanced based on real-world projects.

The findings and analysis were reported following the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [58]. **Figure 2** is a PRISMA flow diagram which illustrates the study selection process. The key findings were summarised, highlighting the essential components. The limitations and potential biases of the review were discussed, and recommendations for future research and implications for practitioners were provided. By adopting the PRISMA-based method, this study ensures a rigorous and transparent approach to reviewing and analysing the components and effectiveness of incentivising strategies in flexibility markets. The systematic procedure guarantees the inclusion of relevant studies and reports, contributing to a comprehensive understanding of sustainable and renewable energy practices in flexibility markets [17]. The key steps of this procedure are outlined below.

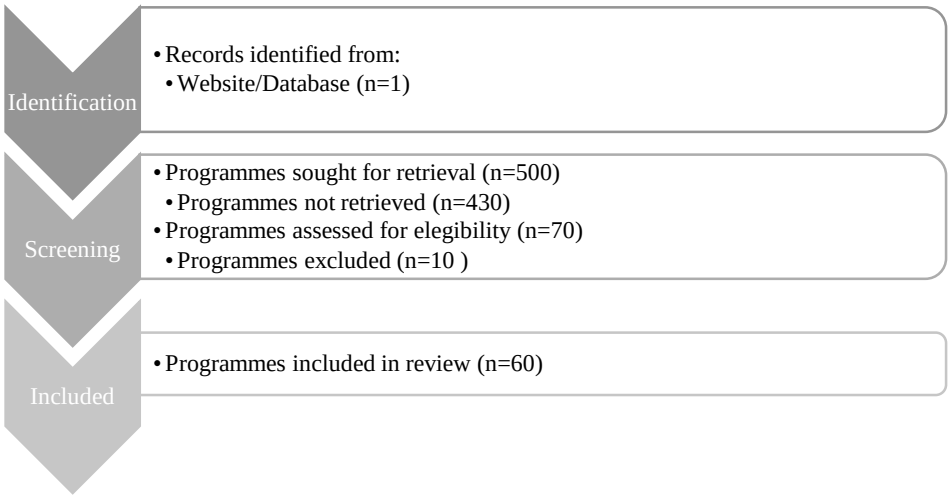


Figure 2. PRISMA adapted flow diagram (Adapted from [58])

3.1 Research Question and Inclusion Criteria

The research question guiding this study is: "What are the main components of incentivising strategies offered by Aggregator for SL-FSP in flexibility markets?" To address this question, clear inclusion criteria were established to select relevant reports and studies. The criteria focused on demand response programmes in the United States, specifically examining the components of their incentivising strategies.

3.2 Project Search

A comprehensive search strategy was developed using relevant keywords such as "demand response," OR "flexibility markets," AND "incentivising strategies." The search was conducted across multiple databases and sources, with a primary emphasis on the US Department of Energy website [30]. The search aimed to retrieve reports and studies published within the last years that met the inclusion criteria.

3.3 Study Selection

The United States was chosen for the review due to its prominent role in spearheading the introduction and advancement of Aggregators [32]. The US market is considered one of the most developed for flexibility provision. It offers a wide range of flexibility programs targeting the reduction of electricity demand during peak usage times. Other countries may lag in development or have limited availability of information. Additionally, the information available for the US market is transparent, making it a suitable choice for the review.

The primary source of information for the review was the US Department of Energy Studies. A search for the keyword "demand response" on the US Department of Energy website [30] retrieved many reports. The Federal Energy Management Program, under the general program "Demand Response and Time-Variable Pricing Programs," developed profiles of demand response and time-variable pricing programs across the United States. These profiles were categorised regionally by state, including Western States, Northeastern States, and Southeastern-Midwestern States.

3.4 Data Extraction and Quality Assessment

A data extraction form was developed to capture relevant information from the included reports. To extract information on various demand response programmes in each region, one large state was selected per region (California, New York, and Florida), and all the projects offered in the state were included in the review. This selection aimed to understand the incentives offered to customers and identify key elements of the incentivising structure in these programs.

It is important to note the differentiation of customer types, specifically Small Load (SL) providers and High Load (HL) providers. SL providers are Residential customers with an average capacity of approximately less than 10 kW, referred to as SL-FSP in this paper. HL providers are Commercial and industrial customers with variable

capacities, typically ranging from 50 kW to 500 kW or higher (HL-FSP). In some programs, SL-FSP providers could join forces through an aggregator to become HL-FSP. The projects were filtered accordingly to focus on the relevant customer types: SL-FSP.

3.5 Data Synthesis and Reporting

The reviewed projects were read multiple times to identify the components of the incentivising model used inductively. Once these components were identified, each project was critically evaluated against the objectives or goals established in the foundations to assess whether the incentivising model used met the established principles. The process revealed aspects that were not adequately addressed, leading to the proposal of additional components or properties in each component.

4. Value-Incentivising Framework Development

The framework is divided into two nested layers (Table 2). The first layer depicts the core elements of the incentivising strategy, whereas the second layer comprises the components that enhance others and fulfil the foundations established at the outset. The first layer of the framework comprises three components that reflect what is being paid (WHAT), who receives the incentive (TO WHOM) and what type of incentive is provided (HOW). These incentives can take various forms, including bill discounts or subsidised equipment, distinguishing between monetary (direct and indirect) and non-monetary incentives. By offering these incentives, the framework ensures that the aggregator achieves critical mass and versatility from participating customers [11], [12].

However, it is important to note that relying solely on these incentives is insufficient to guarantee the long-term viability of the aggregator's business. Therefore, it becomes crucial to establish a baseline of benefits that can be adjusted, either increased or decreased, based on other components within the framework. These other components are included in the second layer of the framework and play a crucial role in balancing the goals of the aggregator, including their duty to meet the technical specifications defined by DSO/TSO and the customers' needs. By incorporating these components, the framework aims to meet the principles of reliability and loyalty [28], [44].

Table 2. Value-Incentivising-Component Framework

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">FIRST LAYER: CORE COMPONENTS
Ensuring critical mass & versatility from Customer</td><td colspan="2">SECOND LAYER: COMPONENTS FOR BALANCE
Ensuring reliability & loyalty from Customers</td></tr>
<tr><td>AVAILABILITY</td><td>ACTIVATION</td><td>PENALTIES</td><td>PERMANENCE</td></tr>
<tr><td colspan="2">WHAT?
HOW?</td><td>Per kW committed in a given period;
Per device committed in a given time, which includes Retrofit in some cases</td><td>Real participation in the event</td><td>Consider: Loss Aversion</td><td>Escalating incentives based on the duration of participation</td></tr>
<tr><td rowspan="2">MONETARY INCENTIVE</td><td>DIRECT</td><td>$/kW
(Discounts or direct payments)</td><td>$/kWh
(Discounts or direct payments)</td><td rowspan="3">Possibilities:
An economic penalty for every not-responded event;
an economic penalty for a determined quantity of not-responded events</td><td rowspan="3">Possibilities:
not required;
Permanence required for a determined number of months, for winter/summer, a year, etc.</td></tr>
<tr><td>INDIRECT</td><td>Possibilities:
Free technical assistance Retrofit
Rebates in equipment
Loyalty rewards</td><td>Possibilities:
Free technical assistance Retrofit
Rebates in equipment
Loyalty rewards</td></tr>
<tr><td colspan="2">NON-MONETARY INCENTIVE</td><td>Possibilities:
Emission reduction or green certifications</td><td>Possibilities:
Emission reduction or green certifications</td></tr>
<tr><td colspan="2">TO WHOM?</td><td colspan="4">Customer, another customer, organisation</td></tr>
<tr><td colspan="2">PRICE MODULATORS</td><td colspan="4">Service Characteristics: ensuring response to DSO/TSO</td></tr>
</table>

4.1. Layer one: incentivising components that ensure critical mass and versatility

The first component of the framework reflects WHAT is being paid: Availability and activation. This first component of the incentivising framework involves determining what aspect of flexibility provision should be compensated. Customers can be paid for availability, activation, or a combination. Activation refers to the actual participation of customers in a specific event in an incentive-based programme. The customer's involvement depends on whether they have a contract with the aggregator, which determines their commitment to participate in the program. In contrast, availability refers to the customer's commitment to engage in the program with a specific power capacity. By carefully designing incentivising strategies that consider both availability and activation, aggregators can create a robust and reliable ecosystem of flexible resources while ensuring the satisfaction of customer needs [59]–[72].

Availability is particularly relevant in incentive-based programs, where customers commit to providing a certain power capacity during a specific timeframe. There are two common methods of participation based on availability: per kilowatt committed and device committed. Availability per kilowatt (kW) committed involves compensating customers who commit to providing a certain power capacity during a specific period, regardless of whether flexibility events are called or not. Availability per device committed refers to incentivising customers to commit specific devices, such as a heating system, for flexibility. For example, in the Smart Thermostat Programme, customers are awarded $85 per enrolled thermostat [70].

A blended approach combining availability and activation compensation seems the best strategy to attract and incentivise customers effectively. For example, the Distribution Load Relief Program (DLRP) pays participants between $18 and $25 per kW for each month of enrolment, as well as $1/kWh for actual event reductions [71]. Paying only for availability without activation may enable aggregators to gather data and participate in capacity (availability-based) markets. Still, it may lack the reliability of an actively engaged customer base. Conversely, paying only for activation without considering availability might not provide enough incentives for customers to commit to their flexibility capacity, limiting the overall effectiveness of the flexibility program. A blended approach allows aggregators to gather valuable data while ensuring a reliable response when events occur.

The second component of the framework reflects HOW is being paid: The type of incentive. In the reviewed projects, monetary and non-monetary incentives were utilised to motivate customers to participate in flexibility programmes [59]–[72]. These incentives aim to either increase benefits or reduce costs for customers. Monetary incentives were dominant in the reviewed projects. For example, in California, the Base Interruptible Program (BIP) offered by PG&E [68], SCE [69], and SDG&E provides monetary compensation to participants who agree to reduce their electric load to or below a pre-selected level known as the firm service level (FSL). This level is typically set below the customer's historical average maximum demand.

Monetary incentives can be implemented in diverse forms, contingent on the overarching objectives of the programme. These can be classified as direct or indirect incentives. About direct incentives, a financial sum is conferred upon the customer, for example, as a bill reduction or outright payment. Furthermore, indirect monetary incentives can be rebates or subsidised retrofit programs. Customers can receive rebates or discounts on electrical equipment in exchange for making their devices available for flexibility purposes. For example, customers who enrol their smart thermostats in an incentive-based program may receive a $50 rebate on the equipment [72].

Within the gamut of indirect monetary incentives, several methods stand out for their ability to bolster the perceived value and effectiveness of sustainable energy programmes. Value-added services, such as complimentary technical assistance, energy audits, or the provision of extended warranties, not only enhance the perceived value of participation but also proactively assist in realising the programme's objectives. Free technical assistance, a free energy audit, insurance, or support services can encourage participation and provide customers with additional value. For example, the automated demand response (auto-DR) offered by PG&E [64], SCE [65], and SDG&E provides free technical assistance to customers for installing automated DR equipment [64]. Moreover, even though they are not evident in the projects analysed, forging collaborations with local businesses, institutions, or government entities can offer mutual advantages. Such partnerships might involve customers receiving discounts or complimentary access to locally organised events or even free passes for public transportation.

In addition to monetary incentives, non-monetary incentives may be crucial in motivating customer participation, such as recognition for emissions reduction through badges or prizes. For instance, green certifications, which customers can prominently display on their properties or digital platforms, not only serve as a testament to their eco-conscious endeavours but can also indirectly augment their marketplace reputation and appeal, thus intertwining sustainability with tangible reputational advantages. This kind of incentive does not appear in the reviewed projects.

A holistic approach, combining monetary and non-monetary incentives, can enable critical mass and reliability. A more versatile incentive structure may help attract a wider customer base, as it addresses the diverse motivational profiles and values sought by different customer segments. For instance, while some customers might be primarily motivated by direct financial gains, others might place a higher value on societal recognition, environmental stewardship, or the intrinsic satisfaction of contributing to a greener future. By offering various incentives, programmes can appeal to those with varied assets and motivations, from homeowners with solar panels to small commercials with advanced energy management systems.

The third component of the framework reflects WHOM is being paid: The beneficiary of the incentive. A third component in the first layer of the framework is the recipient of the incentive. In the reviewed projects, the incentive recipient was the customer providing flexibility. However, there could be other approaches where the incentive recipient is a different actor from the flexibility provider. The potential beneficiaries can be categorised into three main groups: the end-customer themselves, another end-customer (e.g., a neighbour or family member in need), or an NGO or organisation. Choosing another end-customer as a beneficiary allows customers to extend their impact in the community. This feature allows participants to support neighbours or family members who may be facing financial constraints or energy-related challenges and to contribute to flexibility or energy justice [25], [73].

This compensation tactic aligns with the social gains expected by customers for their flexibility provision, mentioned in the foundations. By allocating their energy savings or excess energy to individuals in need, customers contribute to the well-being and resilience of their local community. This aspect fosters a sense of social responsibility and solidarity, motivating participants to participate in load reduction activities actively [25]. Selecting an NGO or nonprofit organisation such as a school or local library, as a beneficiary offers customers a chance to support a cause or entity aligned with their values and interests. Participants can donate their energy savings or excess energy to organisations dedicated to environmental conservation, social welfare, or other relevant causes. This feature establishes a connection between energy consumption and philanthropy, promoting a broader understanding of the positive impact that sustainable energy practices can have on society [25], [73]. It encourages participants to view their energy choices to create positive change beyond their immediate surroundings. By offering customers the choice to benefit themselves, other end-customers, or NGOs/organisations, the aggregator may increase the perceived value as these choices increase the perceived empowerment, social responsibility, and philanthropic engagement. This feature expands the impact of energy conservation efforts. It encourages participants to view their energy consumption to contribute to their well-being, help others in need, and support meaningful causes.

4.2. Layer two: incentivising components ensuring reliability and loyalty from customers, guaranteeing the Response to the DSO/TSO

The second layer of the framework, nested within the primary layer, serves to refine the core components. This layer aims to bolster the reliability and loyalty of customers [28], [44]. These components effectively balance the foundational elements of the first layer. In the early phases, aggregators should emphasise the primary components as they lay the groundwork, allowing them to establish initial contracts with DSOs/TSOs. However, as aggregators mature, the initial layer's effectiveness can be amplified by integrating supplementary components. They are designed to address evolving challenges and capitalise on emerging opportunities. For instance, they enable the development of ancillary services and facilitate data-driven services. Such strategic integrations not only diversify the service portfolio but also offer evidence-backed justifications for their importance and effectiveness. Additionally, incentives can be structured to bolster loyalty. Examples include escalating incentives correlating to a customer's duration of participation. Availing customers of cross-sell services, which are complementary services

that may pertain to other sectors like health or mobility, at reduced rates after a defined engagement period or offering tailored energy audits grounded in consumption patterns [59]–[67].

The fourth component of the framework is the inclusion of penalties. Penalties play a crucial role in determining the dynamics of participation within a programme, aiming to maintain reliability and loyalty. Broadly, penalties can be categorised into three predominant strategies: absence of penalties, existence of penalties, and application of penalties only under certain circumstances. In the first scenario, participants are exempt from penalties, even if they choose to exit the programme or abstain from participating in activation events. Such a model particularly appeals to risk-averse customers who value autonomy in deciding their engagement level. Yet, from the aggregator's standpoint, this absence introduces a heightened degree of unpredictability, potentially undermining commitment and jeopardising the business model's viability. Notably, should the aggregator fail to maintain the stipulated voltage or capacity, the DSO/TSO may impose penalties. Notably, should the aggregator fail to maintain the stipulated voltage or capacity, the DSO/TSO may impose penalties. However, it is pertinent to note that in the review of projects from the US, explicit mentions of penalties have been found in less than 1% of the cases [71].

Conversely, some programmes impose penalties for customers who do not adhere to load reduction requirements, with the penalty magnitude being contingent upon the utility and chosen incentive structure. The primary intent behind the 'existence of penalties' approach is to bolster compliance and long-term engagement. However, this can augment anticipated costs for participants, leading to potential hesitations if the penalties seem excessively stringent or invasive. Certain programmes, like the Base Interruptible Programme (BIP) designed for HL-FSP, employ such penalty mechanisms [64]. Insights from Behavioural Economics indicate a predominant loss aversion amongst individuals, implying a heightened sensitivity to losses than equivalent gains [74], [75]. Recognising this cognitive bias can guide the crafting of incentives and penalties in a manner conducive to bolstered participation while concurrently curtailing any aversion to potential losses. Striking a harmonious balance by judiciously applying penalties can pave the way for a framework that not only incentivises customer involvement but also diminishes operational uncertainties and augments programme efficacy. Such a balanced tactic considers the psychological intricacies influencing decisions, harnessing principles of behavioural economics to refine participation metrics.

In a bid to counteract potential non-responses, the introduction of 'soft penalties' might be deemed apt. For initiatives like subsidised retrofit or flexibility provision rentals, penalties can be levied for non-compliance. For instance, subsidised retrofits may stipulate a minimum tenure or a set number of activations; failing to meet these criteria could incur penalties, ensuring the aggregator does not bear undue risk. Similarly, if compensation hinges on a blend of activation and availability, yet no activations materialise, penalties should be in place. However, they may not be presented as such. To illustrate, instituting a minimum number of activations to qualify for incentives or elevating the incentive amount contingent upon reliability could manifest as viable 'soft penalty' methodologies. It might also be feasible to offer a leeway wherein flexibility is not provided by establishing a designated number of times with no penalties. Surpassing this threshold should instigate the imposition of a penalty [59]–[67].

The fifth component of the framework is the permanence of the programme. The principle of sustained engagement is paramount for programme administrators aiming to measure the programme's impact over an extended horizon. By tracking the energy consumption behaviours of participants over time, valuable data can be amassed, offering deep insights to refine programme strategies. This longitudinal assessment can highlight evolving trends, pinpoint challenges, and reveal untapped opportunities, bolstering the programme's overall efficacy.

To foster this prolonged engagement, pricing strategies play a pivotal role. Incentive structures can be designed to reward longevity in the programme. For instance, escalating incentives based on the duration of participation could be implemented. Participants might receive a certain monetary benefit for their initial engagement. Still, if they remain in the programme for a year, they could be gifted with a bonus, such as a complimentary energy audit. This not only underscores the participant's commitment but also reinforces their trust in the programme, merging pricing principles with loyalty.

By intertwining pricing and loyalty, administrators can optimally leverage the benefits of immediate participation and long-term commitment. Such a model, inspired by findings from papers on pricing loyalty [76]–[78], ensures participants are not just drawn to the programme but are also incentivised to stay. This combination of immediate rewards and long-term benefits can drive both the success of energy programmes and the sustained energy-saving behaviours of its participants.

5. Discussion

This study aims to devise an incentive framework tailored to flexibility markets, encapsulating the vantage points of aggregators, customers, and the requisites of DSO/TSO. Employing an inductive methodology and adhering to the pivotal stages of systematic reviews, we have sculpted a bifurcated framework enriched with five salient components. This framework unravels the intricate dynamics between the aggregator, customer, and DSO/TSO. Recognising these interconnections allows the crafting of an optimally calibrated incentive mechanism that reciprocates benefits to all stakeholders. The merits of this framework are manifold:

- Structured Insight: The framework diligently segments incentive strategies, categorising them into two tiers, further branched into quintessential components. This structure empowers aggregators with a blueprint to engineer and deploy incentive regimes.
- Panoramic Perspective: It offers a holistic understanding of incentive strategies, from their nature, intended recipients, and administration to ancillary elements anchoring customer fidelity. Such meticulous design ensures thoroughness, forestalling potential oversights.
- Versatility: The framework, while providing varied options for each segment, adapts to technical specifications, the market's maturity, and divergent customer motivational profiles. This adaptability ensures a tailored approach, resonating with aggregator objectives and customer inclinations.
- Reinforced Commitment: Emphasising facets like potential penalties and the ethos of continuity, the framework engenders steadfast customer allegiance, pivotal for the aggregator's enduring operational success and commitment to DSOs/TSOs.
- Societal Footprint: Transcending mere operational aspirations, it underscores societal ramifications, fostering societal goodwill by enabling customers to bequeath benefits to their community or NGOs.
- Iterative Enhancement: The framework's tiered design advocates for continual refinement, ensuring strategies evolve with shifting circumstances or deepened customer insights.
- Empirical Orientation: By accentuating long-term program evaluation, it galvanises aggregators towards data-informed decision-making.
- Collaborative Prosperity: It ensures mutual rewards for all stakeholders, weaving a tapestry of collaborative success.

Based on the findings, it is evident that designing an effective incentivising framework requires considering the diverse needs and preferences of customers. Future research should consider the empirical assessment of the framework, examining how the different components should play out depending on customer profiles and preferences. Also, future research should explore the applicability and effectiveness of the proposed incentivising framework in different contexts and markets. Additionally, the technical and regulatory aspects of aggregator business models should be further investigated to ensure the successful implementation of the framework.

This study contributes to the literature by developing an incentivising framework for flexibility markets that balances the goals of aggregators and the needs of customers, considering the demands and technical specifications stipulated by the SO. The framework highlights the importance of critical mass, versatility, reliability, and loyalty as key conditions for the viability of the aggregator business model. By considering customer motivations and concerns, personalised incentivising strategies can be developed to enhance customer engagement and optimise flexibility provision. The proposed framework provides a foundation for future research and practical implementation, ultimately promoting the integration of renewable and sustainable energy sources into the electricity system. The Value-Incentivising Framework Development is not just a theoretical model; it is a practical tool that provides clarity, structure, and direction. Its application can help drive the transformation of the energy sector, ensuring that as we transition to more sustainable and flexible energy systems, all stakeholders thrive and benefit.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Grammarly in order to improve language and readability. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Data availability

https://www.energy.gov/femp/demand-response-and-time-variable-pricing-programs

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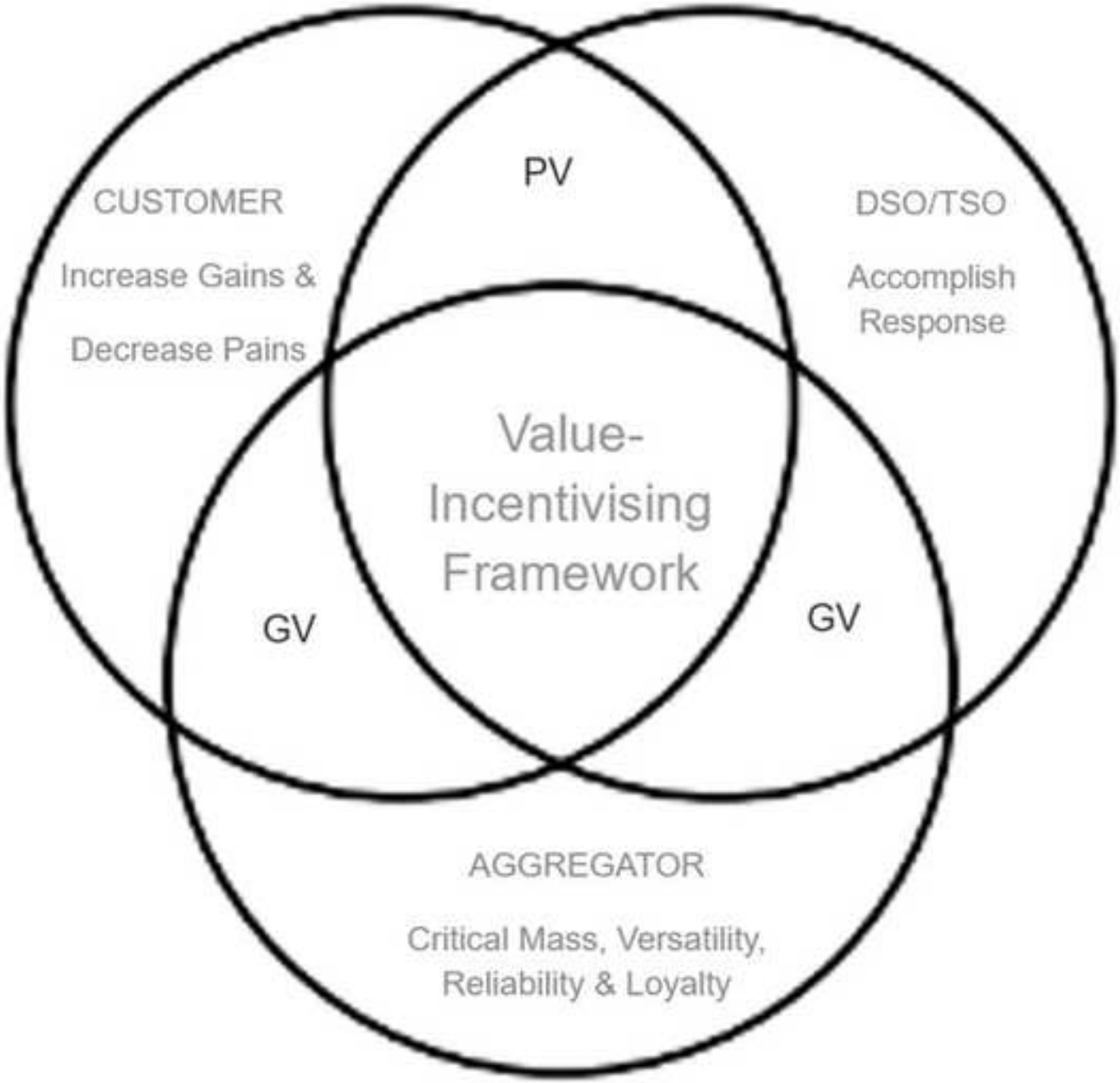
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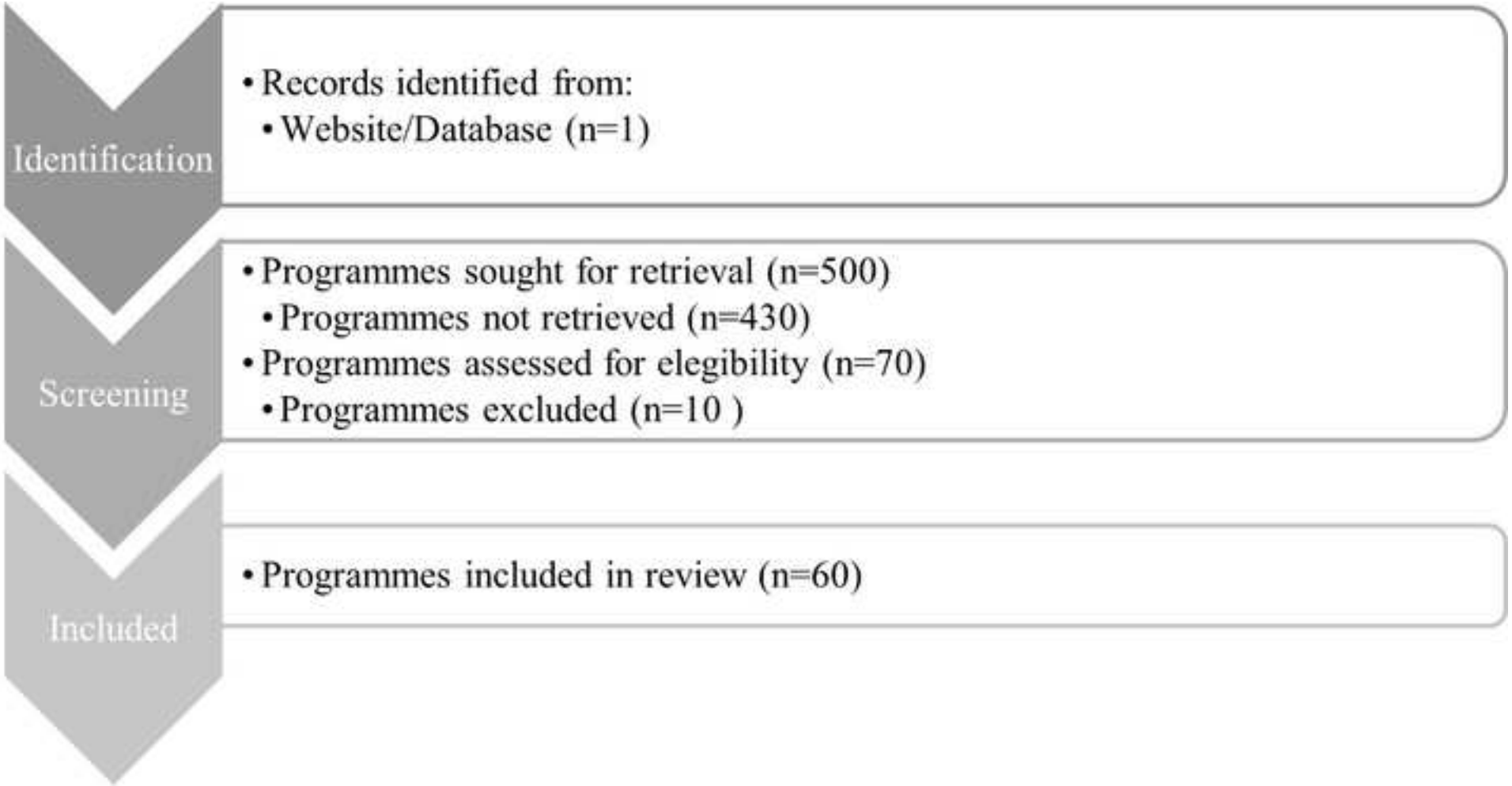


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Table 1. Response to DSO/TSO

Service Characteristics	Definition	REF	Price modulator
Notice time (Advance Notice)	This advance notice empowers participants to plan and adjust their energy usage; for example, the notice time could be 1 day, 2 hours, 15 minutes, etc.	[55]	Negative: The greater the advance notice, the lesser the amount
Timeframe	Temporal specification within the event will occur during the summer or winter seasons, on weekdays or weekends, and at specific hours.	[55]	Negative: Defined timeframes offer fewer amounts
Frequency of activation (Number of notices or frequency)	The number of notices participants receive within a period, for example, a given month.	[55]	Positive: The greater the number of notices, the greater the amount
Preparation period	The period between the request by the SO and the start of the ramping period.	[54]	Positive: Longer preparation periods lead to greater amounts
Ramping period	The period during which the input and output of power will be increased or decreased until the requested amount is reached.	[54]	Positive: Longer ramping periods lead to greater amounts
Full activation time	The period between the activation request by the SO and the corresponding full delivery of the concerned product.	[54]	Positive: Longer activation times lead to a greater amount
Minimum/maximum quantity	The power (or change in power) which is offered, and which will be reached at the end of the full activation time.	[54]	Positive: Higher quantities or changes in power offer a greater amount
Minimum/maximum duration of delivery period	The minimum/maximum length of the delivery period during which the service provider delivers the full requested change of power in-feed to or the full requested change of withdrawals from the system.	[54]	Positive: Longer delivery periods lead to a greater amount
Deactivation period	The period for ramping from full delivery to a set point or from full withdrawal back to a set point.	[54]	Positive: Longer deactivation periods lead to a greater amount
Granularity	The smallest increment in volume of a bid.	[54]	Positive: Larger bid increments lead to greater amount
Validity period	The period when the bid offered by the FSP can be activated, where all the characteristics of the product are respected. It is defined by a start and end time.	[54]	Positive: Longer validity periods lead to a greater amount
Recovery period Minimum	Minimum duration between the end of the deactivation period and the following activation.	[54]	Positive: Longer recovery periods lead to a greater amount
Mode of activation	The mode of activation of bids, i.e., manual, or automatic. Automatic activation is done automatically during the validity period, whereas manual activation is done at the request of the SO.	[54]	Automatic activations offer a greater amount

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Table 1. Value-Incentivising-Component Framework

		FIRST LAYER: CORE COMPONENTS Ensuring critical mass & versatility from Customer		SECOND LAYER: COMPONENTS FOR BALANCE Ensuring reliability & loyalty from Customers	
WHAT? / HOW?		AVAILABILITY	ACTIVATION	PENALTIES	PERMANENCE
		Per kW committed in a given period; Per device committed in a given time, which includes Retrofit in some cases	Real participation in the event	Consider: Loss Aversion	Escalating incentives based on the duration of participation
MONETARY INCENTIVE	DIRECT	$/kW (Discounts or direct payments)	$/kWh (Discounts or direct payments)	Possibilities: An economic penalty for every not-responded event; an economic penalty for a determined quantity of not-responded events	Possibilities: not required; Permanence required for a determined number of months, for winter/summer, a year, etc.
	INDIRECT	Possibilities: Free technical assistance Retrofit Rebates in equipment Loyalty rewards	Possibilities: Free technical assistance Retrofit Rebates in equipment Loyalty rewards		
NON-MONETARY INCENTIVE		Possibilities: Emission reduction or green certifications	Possibilities: Emission reduction or green certifications		
TO WHOM?		Customer, another customer, organisation			
PRICE MODULATORS		Service Characteristics: ensuring response to DSO/TSO			

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Highlights:

- The two-layer, five-component framework boosts SL-FSP engagement.
- Harmonized incentives align aggregator, customer, and DSO/TSO needs.
- Framework provides a strategic blueprint for effective incentive categorisation.

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