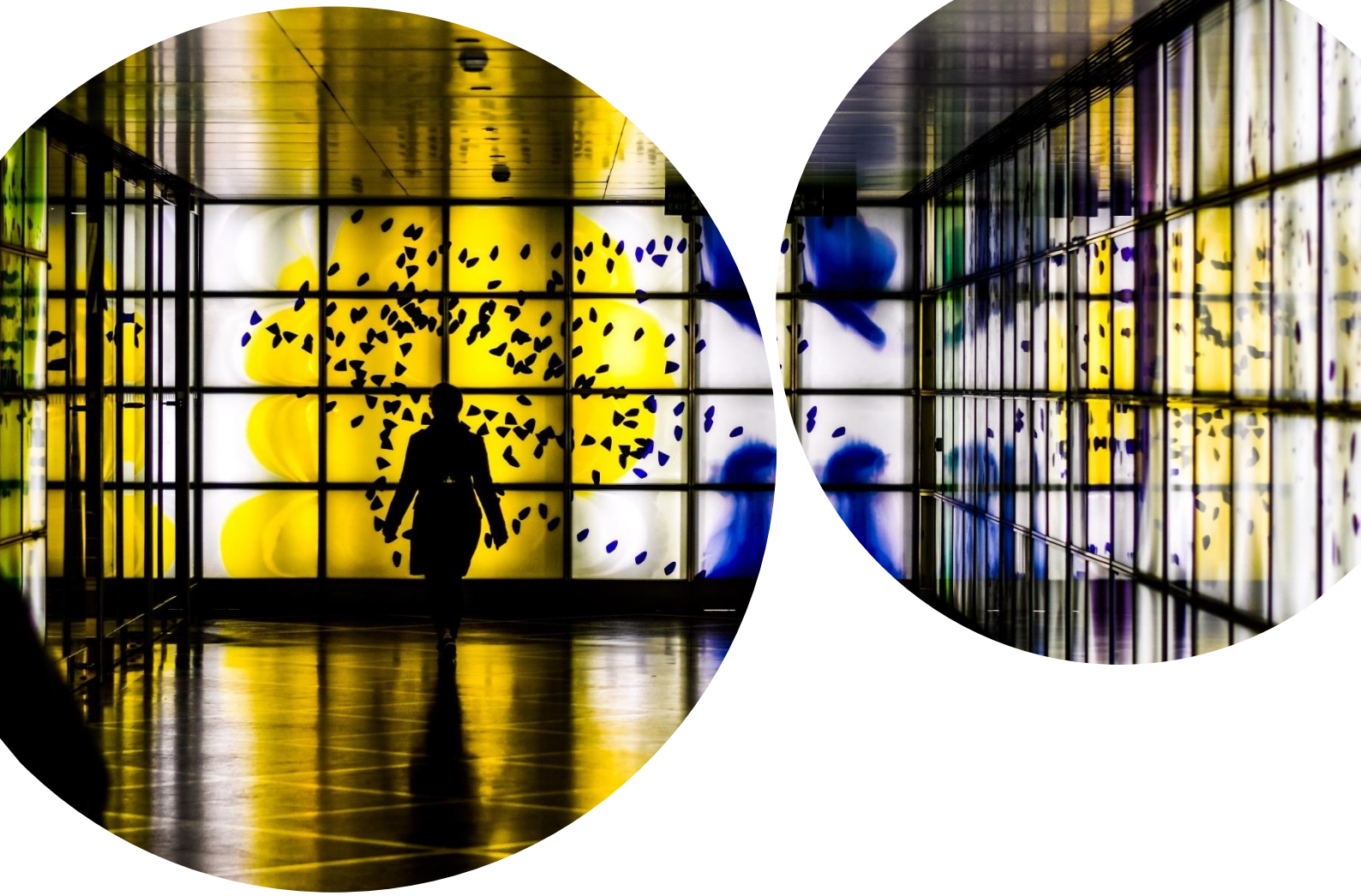
Maximising Social Welfare of Energy Storage Facilities through Multi-Service Business Cases

Brussels, April 2019



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I. Introduction

In November 2018, the European Commission presented its strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050, which seeks to establish a vision on how the EU can deliver on the Paris Agreement. The strategy assesses different pathways for the EU to achieve greenhouse gas emissions reductions between -80% by 2050 (compared to 1990) up to net zero greenhouse emissions by 2050.

All scenarios developed by the European Commission converge on one element: storage capacity will significantly increase to enable integration of higher shares of variable RES in a faster, more efficient way. Total stationary storage used in the power system (i.e. pumped hydro storage, stationary batteries and chemical storage, including the indirect storage effects of producing e-fuels for the final consumers) is expected to reach between 250 TWh to 450 TWh by 2050.[1]

This strong increase in energy storage demand raises questions: how will the market evolve to cope with the need for storage, how will storage services be remunerated, and how can this added value from energy storage be maximised?

While new products arrive on the market to address new needs and hence rewarding storage technologies for their unique capabilities, e.g. the new ancillary services developed in Ireland under the DS3 programme, innovative business cases also emerge. Various EU companies have developed the concept of multi-service business cases:

- Saft, Enel Green Power, EDF, GE and Enedis with the VENTEEA project
- UKPN with the Smarter Network Storage project
- Enedis with its study on smart grids
- RTE with the RINGO project

In the multi-service business case approach (also called multi-service/multi-stakeholder approach in the VENTEEA project), multiple stakeholders are together involved in the ownership, development, management, and/or operation of an energy

[1] In-depth analysis in support of the Commission communication COM(2018) 773, A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy, 2018 https://ec.europa.eu/clima/policies/strategies/2050_e

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storage facility in order to maximise its social welfare by fully deploying all services storage can deliver. EASE looks in this document into the main requirements that need to be fulfilled in order to develop a multi-service business case, in the framework of Articles 36 and 54 of the agreed Electricity Directive (recast), and introduces two configurations of multi-service business cases:

- Well-functioning market: multi-service business case which see interactions between various market players.
- Implementation of derogations to the rule that regulated entities shall not be allowed to own, manage or operate energy storage facilities, as laid out in articles 36 and 54: multi-service business case which sees interactions between a regulated entity – transmission system operator (TSO) or distribution system operator (DSO) – and a market player.

II. Key elements to implement multi-service business cases

As explained in the introduction, multi-service business cases can maximise the social welfare created by a storage facility. Implementing such multi-service business cases requires that:

1. **Stacking of multiple revenues is allowed on one storage facility**: enabling a storage facility to provide various services to various stakeholders (generators, consumers, network operators). 'Stacking' multiple revenues is key to improve the business case for storage. As the International Energy Agency has already concluded, it is important to "develop marketplaces and regulatory environments that enable accelerated deployment, in part through eliminating price distortions and enabling benefits-stacking for energy storage systems, allowing these technologies to be compensated for providing multiple services over their lifetime".[2]

   Indeed, if considered individually, most of the services provided by energy storage facilities do not continuously mobilise 100% of the power/energy

[2] International Energy Agency (2014), Technology Roadmap Energy Storage. https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergystorage.pdf

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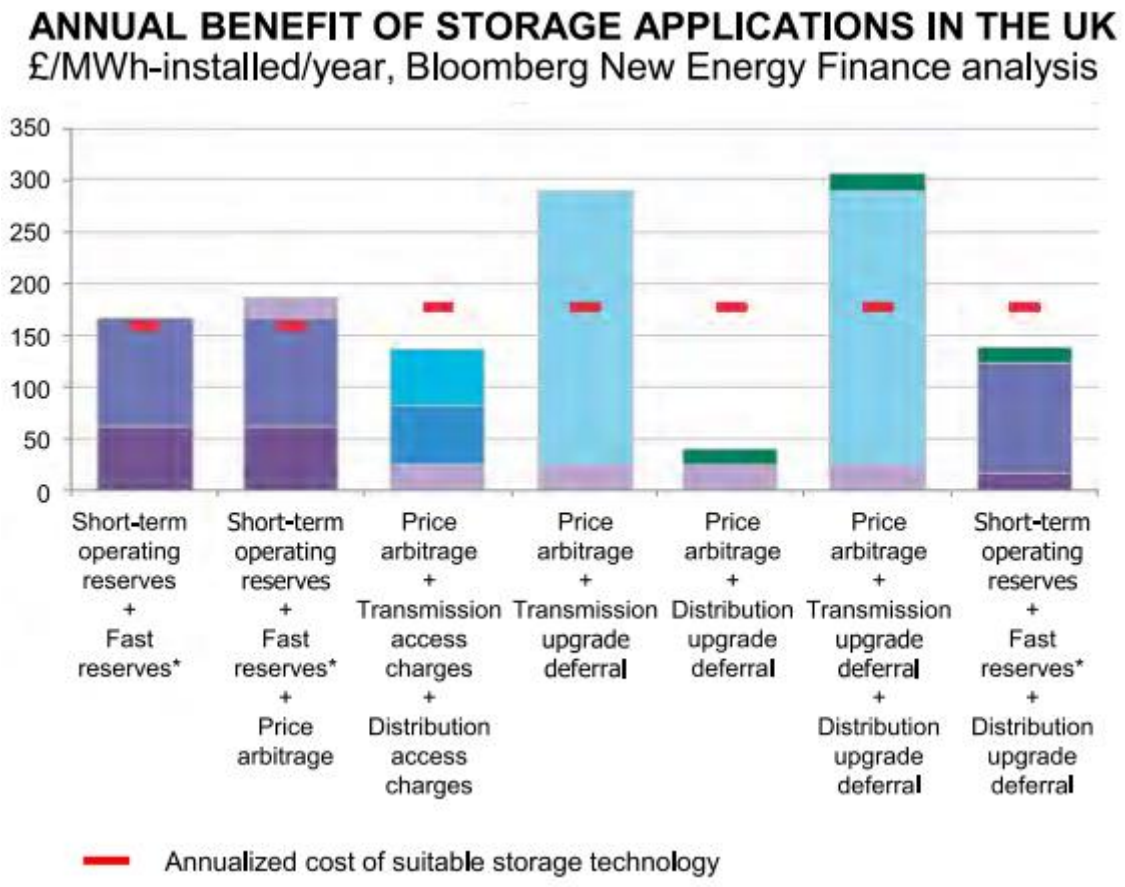
capacities of an energy storage system or do not generate enough revenue to reach profitability[3], and this is illustrated in the following chart:



Source: Bloomberg New Energy Finance

2. **There is a full clarity on the type of services that can be provided by all stakeholders,** notably in the business case which sees interacting on one side a regulated entity and on the other side a market player:
    a. Market players: generation/bulk services and ancillary services.

    Market players can provide services to the electricity system. These services depend on the services approved by the regulatory authorities and the products tendered out in each EU Member State (see section III).

[3] Enhancing the business model of distributed storage through optimized multi-service operation for TSO, DSO and generation owners: the VENTEEA real example, 2016, http://www.cired.net/publications/workshop2016/pdfs/CIRED2016_0375_final.pdf

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b. Regulated entities: infrastructure services by transmission and distribution fully integrated network components e.g. to solve structural congestions or to provide voltage support (see section IV).

The below table details the different storage services that can be provided by energy storage[4]. This list is intended to be indicative and reassessed regularly since the system and markets are constantly evolving.

Generation/Bulk Services	Ancillary Services	Transmission Infrastructure Services	Distribution Infrastructure Services	Customer Energy Management Services
Arbitrage	Primary Frequency Control	Transmission Investment Deferral	Capacity Support	End-user Peak Shaving
Electric Supply Capacity	Secondary Frequency Control	Angular Stability	Contingency Grid Support	Time-of-use Energy Cost Management
Support to Conventional Generation	Tertiary Frequency Control	Transmission support	Distribution Investment Deferral	Particular Requirements in Power Quality
Ancillary Services RES Support	Load Following		Distribution Power Quality	Maximising self-production & self-consumption
Capacity Firming	Frequency Stability of Weak Grids		Dynamic, Local Voltage Control	Demand Charge Management
RES Curtailment Minimisation	Black Start		Intentional Islanding	Continuity of Energy Supply
Limitation of Upstream Perturbations	Voltage support		Limitation of Upstream Disturbances	Limitation of Upstream Disturbances
Seasonal Arbitrage	New ancillary services		Reactive Power Compensation	Compensation of the Reactive Power
Cross-Sectoral Storage				EV integration

Source: Services Provided by Energy Storage, EASE, 2019.

3. **Comprehensive contracts will be signed between all stakeholders involved** in order to clearly identify each stakeholder's responsibilities and clarify important elements of the storage life (e.g. operation, decommissioning). Examples of contractual terms are available in annex I.

[4] The TSO perimeter varies according to the Member states considered and it may happen that in some countries the services provided by DSOs in this chart are provided by the TSO instead. e.g.: in France, 64kV and 90kV lines are part of the Transmission System Operator.

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III. Multi-service business cases in a well-functioning market

Multi-services business cases developed in a well-functioning market consist of multiple players[5] sharing ownership, development, management, and/or operation of an energy storage facility in order to maximise its social welfare by maximising storage revenues and reducing costs. Indeed, having a facility being allowed to deliver only some services, while preventing the delivery and monetisation of some other services might result in a suboptimal utilisation of the storage asset and ultimately in an unprofitable business case, deterring investment and resulting in higher costs to the end consumer.

Multi-service business cases are therefore an efficient solution to mitigate this risk by enabling different players to provide multiple services. The storage facility would provide both infrastructure and system services, which will evolve over time, as well as other products that could be required. Where possible, using the power of the market will be the best way to develop viable business cases, resulting in the highest social welfare.

Multi-service business cases between different market players and potentially regulated entities should be implemented according to a clear regulatory framework, based on the 'Clean Energy For All Europeans' Package, and which will create the fertile ground for innovative market and non-market based services. This framework should at least entail that:

- Revenue stacking is possible, which means that different services may be provided by the same device.
- Detailed agreements have been concluded between all stakeholders, for instance based on contract terms listed in annex I.
- Stakeholders have clearly identified when, how, and by whom storage services will be provided. For instance, a private storage operator could own, develop and manage a storage facility, while a regulated entity could use a defined capacity fraction for non-market based services, the spare capacity could then be used by the market player. This is represented in the below schematic view:

[5] Art. 36 and Art.54 of the Electricity Directive (recast) allow for network operator ownership of 'fully integrated network components' after approval by the national regulatory authority even in a well-functioning market.

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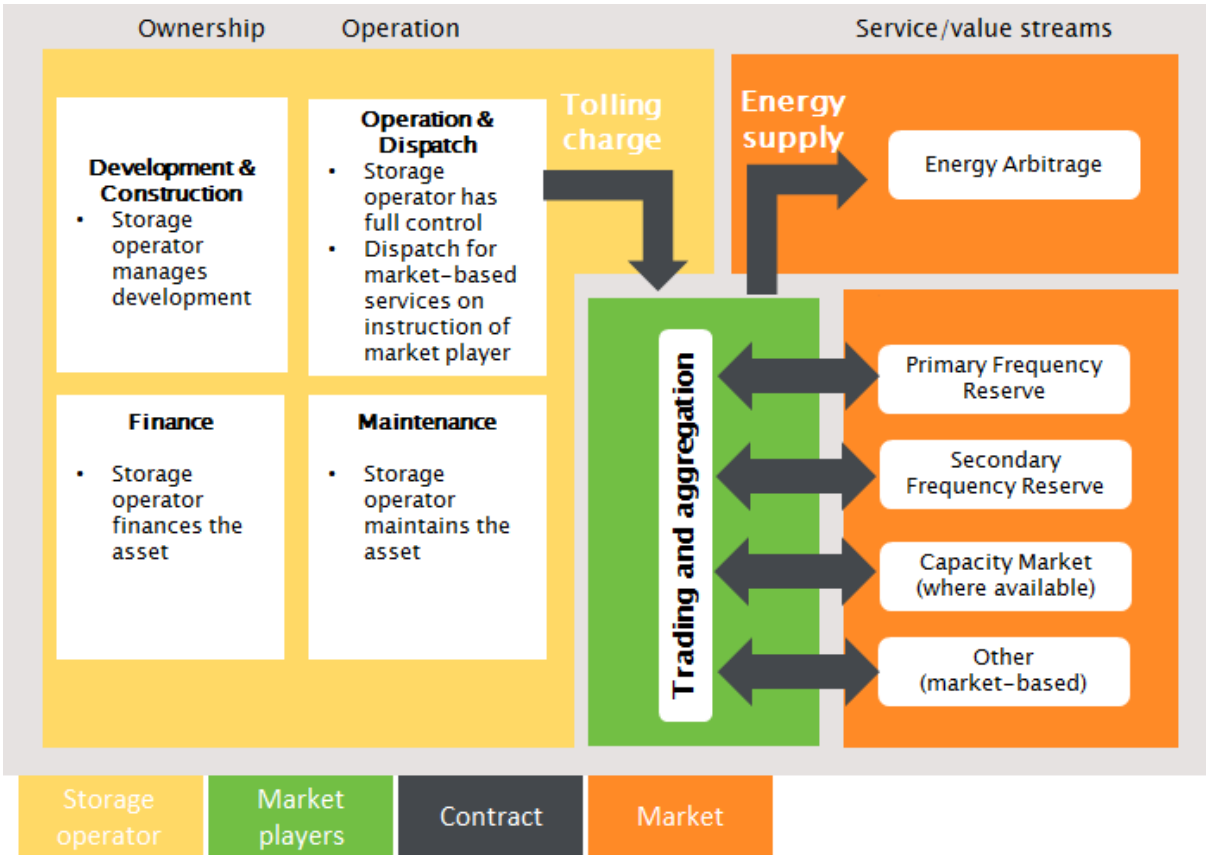

Source: Overview of Multi-Service Business Case Involving Multiple Market Players, EASE, 2019.

IV. Multi-service business cases in the framework of art. 36 and 54

The text of the Electricity Directive specifies that in principle, regulated entities will not be allowed to own, develop, manage or operate energy storage facilities. However, the above provisions introduce two types of derogations enabling regulated entities to own/operate storage facilities under specific circumstances, which is either when the energy storage device is a 'fully integrated network component' (see article 2§39a), or when three conditions are met (see article 36§2 for DSOs and 54§2 for TSOs):

- Following a tendering procedure, market players were not awarded the right to own/operate storage or did not provide a solution at reasonable costs and in a timely manner.
- The energy storage facility is needed to ensure the efficient and reliable operation of the energy system, but is not used to buy and sell energy in the electricity markets.
- The regulatory authority has granted its approval.

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As explained above, energy storage technologies are uniquely flexible and can provide different services which will create different revenues. If the regulated entity operates the storage facility for limited times or services such as grid investment deferral, as it is suggested in articles 36 and 54 of the Electricity Directive, it might not lead to a full optimisation of the storage facility's usage. Therefore, multi-service business cases could be an efficient solution to maximise the social welfare of a storage facility owned/operated by a regulated entity, while keeping in mind that it should not distort the market.

EASE's approach is based on the following assumptions:

- This section reflects the ownership provisions laid out by articles 36 and 54 of the Electricity Directive.
- This section only focuses on situations emerging from a regulatory authority's decision to allow a regulated entity to own and operate a new storage facility. When a regulated entity is allowed to own and operate a new storage facility because the market itself does not deliver the service, this market failure must always be investigated and resolved, as advocated by the Electricity Directive. The progressive evolution of regulation towards incorporating new tools for network planning and operation may also have an impact on services procured on the market (Art 32 and 40.5 of the Electricity Directive).
- EASE does not favour one or any other type of multi-service business case.
- This document is in line with the EASE recommendations on the ownership of storage facilities by regulated entities.

As explained above (II), **multi-service business cases will be needed to maximise the social welfare of a storage facility.** This is also the case for multi-service business cases for which, pursuant to articles 36 and 54 of the Electricity Directive:

- There will be an investment by the regulated entity
- The regulated entity will only be able to provide a limited set of services

In this type of multi-service business cases, the regulated entity would develop, own, operate and maintain the storage asset. **The regulated entity will dispatch the storage asset for infrastructure services while pursuing its primary goal of ensuring a safe and reliable electricity system. A market player will be responsible for providing and monetising market-based value streams, e.g. arbitrage, frequency regulation, etc.**

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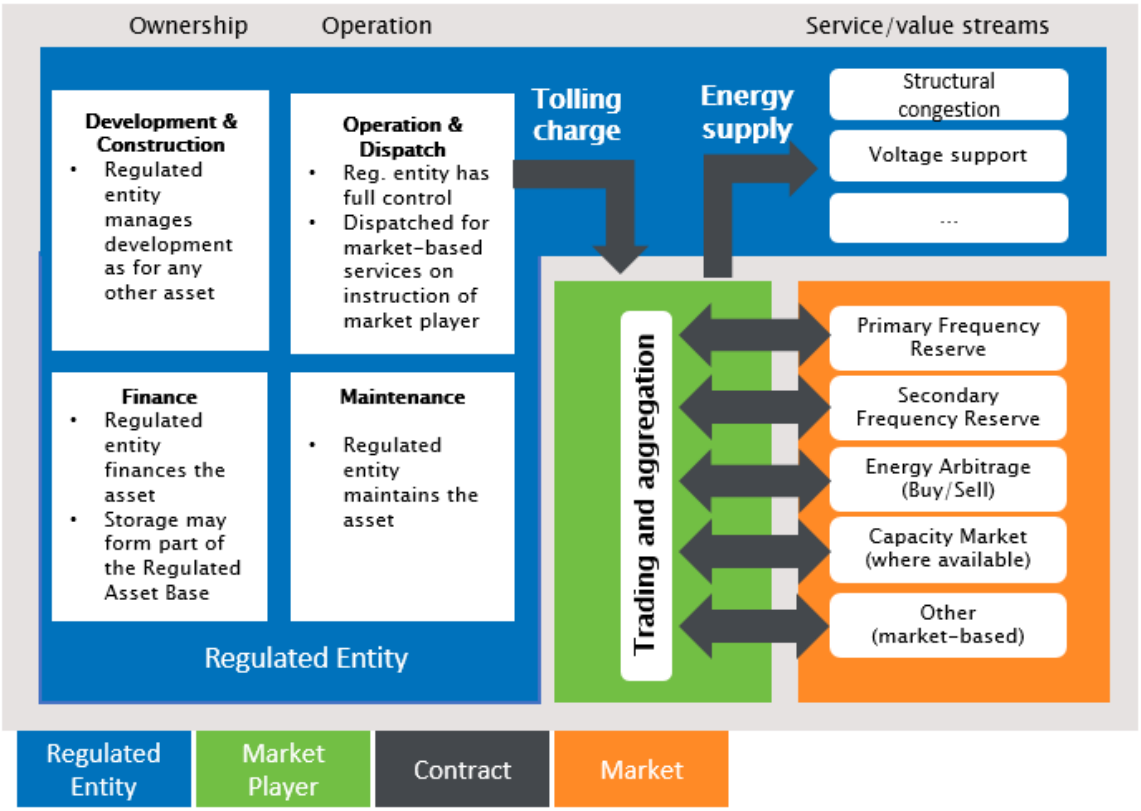

Source: Overview of Multi-Service Business Case Involving a Regulated Entity and a Market Player EASE, 2019.

The following criteria should be respected to ensure that this multi-service business model will be implemented in a practical, technology-neutral, and cost-effective way and does not distort the market, while keeping the principles of proportionality and social welfare in mind:

1. The TSO/DSO, together with the national regulator, based on the assessment of multiple options and input of all stakeholders, should select the storage technology which will be the most suitable to ensure a safe operation of the grid.
2. The sizing of the storage asset should match the TSO/DSO needs to fulfil their obligations for the efficient, reliable and secure operation of the system while taking load evolution for the period in which the solution is planned into consideration.

3. The operation of the storage facility that aims at monetising market-based revenue should be granted to a market player who will have been selected

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following a fair and transparent procedure, e.g. a competitive tender supervised by the regulatory authority, to provide market services.

4. Contractual agreements will have to be clarified to make sure that the services provided by market parties and regulated entities and sharing of costs will be done in an optimal way. Those revenues the regulated owner would receive from the market players would be deducted from the amount that the regulated entity may include in its cost base.

5. Under this model, the market player would enter into e.g. a tolling contract with the regulated owner. The contracting agreement would cover a wide variety of terms, as described in annex I, including terms inserted to comply with articles 36 and 54, paragraphs 4:

    - Periodical review of right to own and operate storage technologies for TSOs and DSOs.
    - Phasing-out from ownership and operation of the storage facility, when required by the national regulatory authority.
    - Compensation scheme to capture the residual value of their investment in the storage facility, at the discretion of the national regulatory authority.

V. Final Considerations

Multi-service business cases are an innovative approach to ensure the bankability of storage. They all imply that stacking of multiple revenues is allowed on one storage facility. EASE therefore calls on policymakers to consider the importance of revenue stacking and multi-service business cases. This principle must be clearly enshrined in all energy storage-related regulations to support the deployment of energy storage technologies.

EASE also calls for encouraging and facilitating by all means innovative and experimental implementation of energy storage solutions, provided those support future flexibility and stability needs of the electricity system. It is indeed crucial to give the largest possible freedom to storage owners/operators as well as to their users, both of which can be market parties or regulated entities, in order to experiment with innovative operation and remuneration schemes.

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Annex I: Non-exhaustive list of terms of agreements to be considered in multi-service business cases

Term of agreement, extensions	Describes the term of the agreement and any extension provisions allowed.
Operation	Describes how, when, and by whom the storage facility can be operated. Specifies the communication protocol between all stakeholders.
Default provisions	Identifies the different provisions for default: e.g. performance, maintenance, implementation, default on payment.
Insurance and credit rating	Describes the insurance and credit rating requirements for the storage facility owner.
Tolling charge	Detail terms and conditions of payment between stakeholders involved. This can be structured as availability and utilisation payments.
Applicable reliability criteria	Generic provision referring to applicable reliability criteria for the storage facility
Maintenance obligation	Generic provision detailing all maintenance obligations
Performance characteristics specification	Detail the performance requirements and electrical characteristics such as MWh, ramp rates, SOC maintenance, MVAR, min/max load, etc.
Performance/availability testing	Describes testing procedures of the storage facility to meet the performance requirements.
Invoicing of cost-process	Describes the invoicing process between the stakeholders involved.
Capital additions and allocation of end of life costs	Specifies the process for requesting, approving and implementing any capital additions required for this project. These could include lifecycle replacements, unplanned capital items and repairs. Will also define the cost obligations of the parties involved for funding capital additions and end-of-life costs including the recycling of batteries, as applicable.

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Interconnection requirements	Describes interconnection requirements and facilities for the storage facility and responsibilities of parties to maintain interconnection facilities
Market participation obligation/restriction	Describes how and when the storage facility can participate in the market. Specifies the communication protocol between the regulated entity and the market player. The regulated entity might retain right to pull the storage facility resource out of market participation if needed for reliability. In such cases the network operator should compensate the regulated entity. May also describe any restrictions around bidding of the resource.
Change of ownership	Describes change of ownership process in case of derogation expiry and any approval steps required. Describes the methodology to estimate residual value of the asset.
Performance/operational obligation	Details performance obligations of the storage facility as a network resource. Describes how the storage facility resource will respond to the regulated entity dispatch instructions and perform on those instructions. Will detail how the facility will be able to participate in the market, as applicable.
Ancillary services	Describes which ancillary service products this resource is eligible for providing under market participation mode as these can have an impact on the degradation of the storage facility
Service availability	Describes the hours and time periods this resource is available to the regulated entity as a network resource. May specify a minimum service availability requirement and link payment of fixed cost to availability.
Non-performance penalties	Classifies type of penalties, e.g. non-performance against dispatch instruction,

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	missing operating target, unavailability during transmission resource periods. Specifies the calculation of penalties applicable for non-performance.
Regulated entity dispatch process	Describes the process the regulated entity shall follow for dispatching the storage facility, either through manual and/or automated dispatch process
Invoicing of cost-process	Describes the invoicing process between the regulated entity and market player. This will also cover the process for crediting market revenues and how the energy associated with renewable curtailment avoidance will be treated.

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About EASE

The European Association for Storage of Energy (EASE) is the voice of the energy storage community, actively promoting the use of energy storage in Europe and worldwide. It supports the deployment of energy storage as an indispensable instrument within the framework of the European energy and climate policy to deliver services to, and improve the flexibility of, the European energy system. EASE seeks to build a European platform for sharing and disseminating energy storage-related information and supports the transition towards a sustainable, flexible and stable energy system in Europe.

For more information please visit www.ease-storage.eu

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Disclaimer

This response was elaborated by EASE and reflects a consolidated view of its members from an energy storage point of view. Individual EASE members may adopt different positions on certain topics from their corporate standpoint.

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