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Innovation Action



An Integrated Platform for Increased FLEXibility in smart TRANSMission grids with STORAge Entities and large penetration of Renewable Energy Sources



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Deliverable 3.3 – Business models and business cases supporting the secure, sustainable and affordable provision of electricity using flexibility services

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Summary Report

1.1 Scope of deliverable

This deliverable focuses on business models enabling the valorisation of flexibility services, taking into account market and regulatory aspects, paving crucial cornerstones for successful exploitations of results of other project demonstrations.

The project demonstrations include large-scale storage systems and other grid technologies enabling use cases of flexibility. As novel business models are the main focus, this report has carried out a baseline study to assess the current business ecosystem for storage-based business models and out to identify emerging business environment for energy storage and flexibility services. This report provides analysis of storage-based business models and identifying at least three utility or energy service business models in an enhanced market design.

1.2 Concept and background

Energy storage renders value across the entire energy value chain. It can store fuels through conversion processes and mitigate fuel dependency risks as well increase fuel security. For energy generation, it improves efficiency and output optimization, and allows arbitrage for baseload. For transmission and distribution, it improves capacity utilization and grid stability by supporting voltage and frequency regulation. It can also optimize capex for additional T&D infrastructure. For end consumers, it helps in improving power reliability, has a use case for reducing their electricity bills, and provides an opportunity to procure decentralized renewable energy.

The purview of FLEXITRANSTORE project is to address a flexible grid by demonstrating capabilities of Battery Energy Storage Systems (BESS) to provide flexibility capabilities.

1.3 Methodology and key activities

Task 3.1 and Task 3.2 have deliberated on the prevailing regulatory framework and market design, and have further identified gaps to meet an enhanced market design that enables commercialisation of flexibility services.

Our approach for deriving innovative models is to leverage know-how of above knowledge and carry out a baseline study to identify an emerging business environment for energy storage and studying the existing business canvas. We have reviewed 50+ large scale energy storage applications implemented around the world to understand business models currently deployed.

An evaluation of business models has also been carried out in respect to objectives of FLEXITRANSTORE project and proposed demonstrations in SEE region. Our purpose of evaluating business models is to identify models that has the possibility to create a paradigm shift in a new market and has the potential to sustain itself.

The business models are then analysed using business canvas template, describing the relationships between activities, customer segments, revenues and cost drivers. In the subsequent deliverable on business models, we will elaborate on three business cases using cost benefit analysis defined by WP2 D2.3 “*Strategic decision making for power system flexibility by innovation integration*”.

1.4 Key results / findings

Across the energy value chain, storage projects are classified into five types - (i) projects co-located or integrated with renewable generation (ii) projects co-located or integrated with

conventional generation (iii) projects operated by DSO/TSOs (iv) projects operated by third parties (v) projects operated by customers.

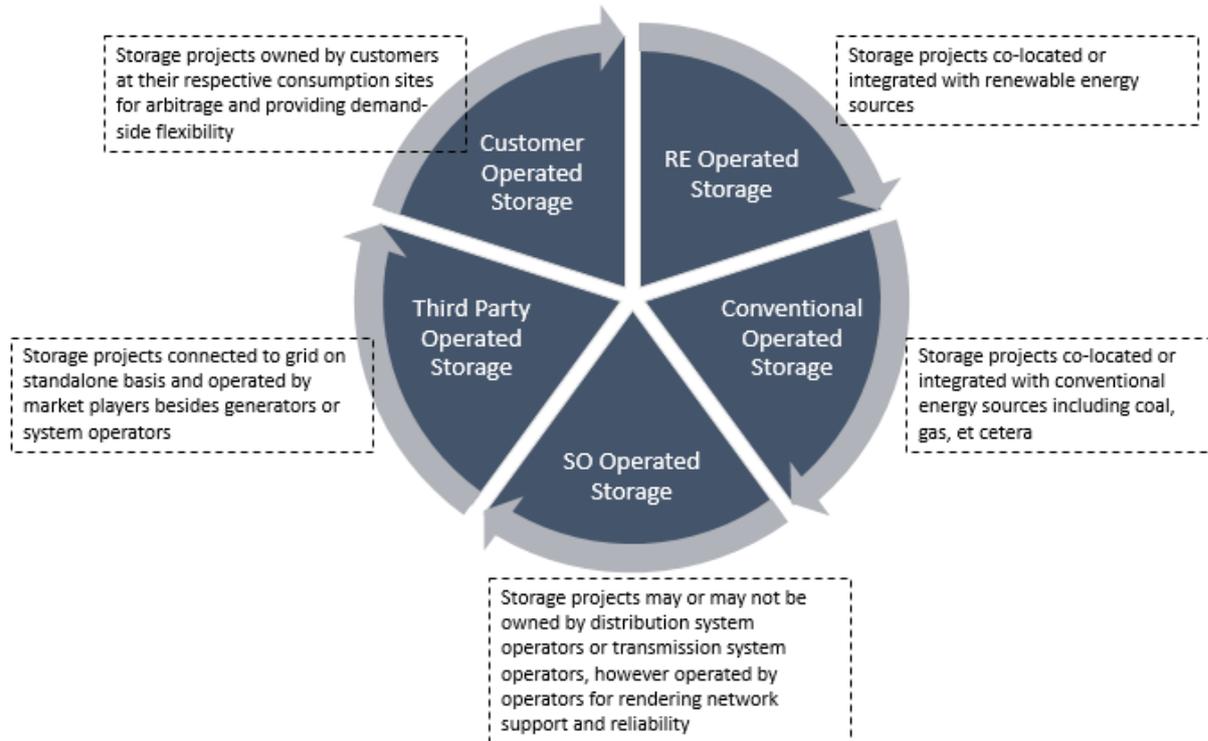


Figure 1: Different business models captured from existing storage projects

These projects are offering diverse value propositions across the energy value chain, however, the most pursued and the most relevant to this project, is flexibility. Flexibility is the capability of the power system to maintain balance between generation and load under uncertainty. It is characterized by the economic order of quantity, response time and duration, wherein each feature dictates the suitability of technology to be used for addressing system needs.

Storage technologies that can store high quantities can be used to cater a broad range of system requirements. Those with fast response time can help in balancing the system in real time. Those with longer durations can address longer disturbances or outages.

Some of the major flexibility services provided in these markets are mentioned below,

- Fast Frequency Response / Primary Reserves / Inertial Response
- Frequency Regulation / Secondary Reserve / Regulation Up & Down
- Spinning Reserves / Tertiary Reserves / Synchronized Reserves
- Non-Spinning Reserves / Non-Synchronized Reserves
- Voltage Support and Angular Stability / Ramping Services
- Black Start Capability

Identification of Business Models for FLEXITRANTORE

Based on available literature and review of multiple projects, business models have been identified operating in the present ecosystem. Further, on discussions with project stakeholders

and partners, models to be explored under FLEXITRANSTORE project have been selected by eliminating non-relevant or established cases.

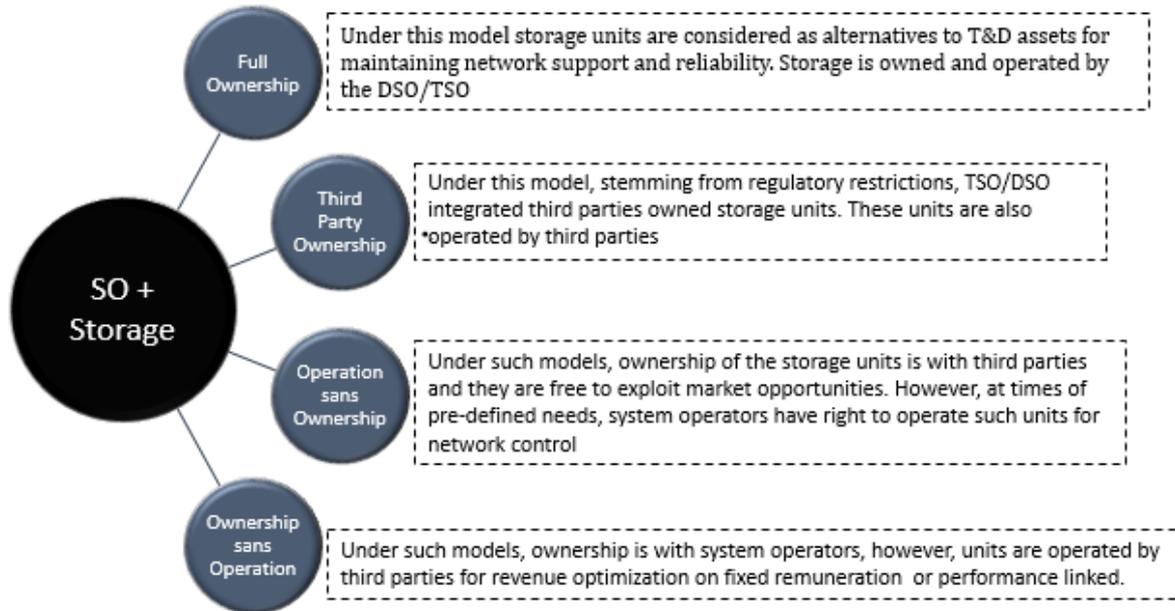


Figure 2 : Operating business model for SO + Storage

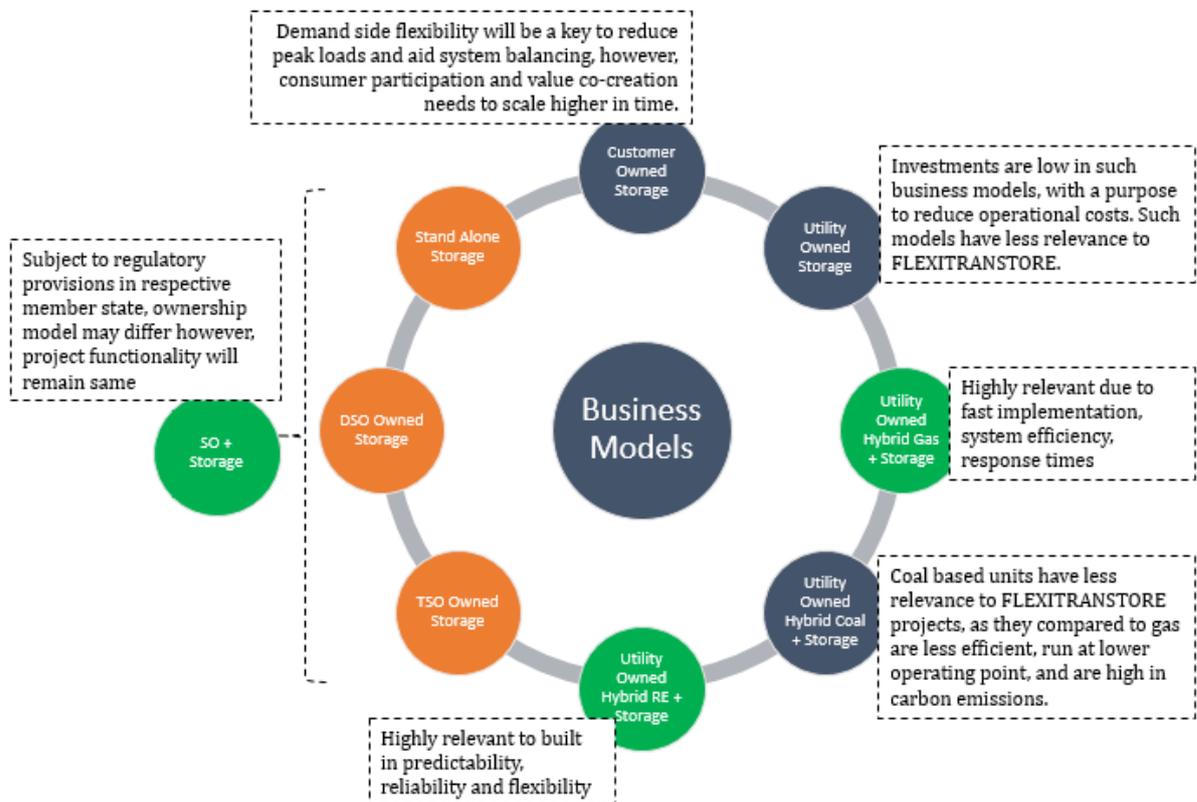


Figure 3: Identification of Business Models for FLEXITRANSTORE

1.4.1 Conventional + Storage

Business model to be explored for a hybrid gas-based plant integrated with battery storage to provide flexibility services, linked to Demonstration 7 – WP11.

Key Partners - Conventional Generators and Third Parties (for optimization services) partner with Battery Manufacturers and EPC for installation and integration of such plants.

Value Proposition - The proposition for such models is to help optimize operation of gas-based generation units and increase revenues captured from the ancillary service markets by providing flexibility.

Channels - Such entities have access to capacity markets and balancing markets for a fixed period of time under a contract, arranges capital from lenders based on guaranteed or expected returns, and services debt and equity by maximizing returns.

Customer Segments - For a flexibility service provider using energy storage, the major customer and user is the system operator.

Relationships - In a flexible grid, flexibility services will be activated either by the DSO or the TSO or an independent service provider. Relationships between flexibility service providers and customer segments in the upper energy value chain are transactional in nature, and is either demanded by an external signal or is automated.

Key Resources - For operating business, one needs physical resources (in this case access to a gas-based unit), engineering resources for storage unit development and integration with core IT components including controllers for communication and operation, and financial resources for CAPEX and meeting OPEX.

Key Activities - These activities are means to produce value proposition and include, providing spinning reserves, that are up and running, ready to move up or down to meet 15-minute to 5-minute signals. To meet sustained peaks in market demand by using batteries as a shock absorber, ramping up to meet these signals while allowing the turbines to run less frequently. To provide contingency reserves, flexible capacity, peaking energy, regulation services, reactive voltage support, and minimized fuel use emissions between dispatch events while supporting ancillary services.

Revenue Streams –

Ancillary Services: It involves using energy storage to provide services for maintaining and supporting grid system reliability. These services include Frequency Regulation (FFR / EFR), Fast Response, Short Term Operating Reserves, Tertiary Reserves, etc. As a service provider, it has to provide above services when called upon or requested by the grid operators. Revenue Realization is based on compensation by grid operators / utilities based on fixed availability fee and a utilization fee (calculated based on quantity supplied for duration as requested by the grid operator)

Capacity Market: It involves using energy storage to provide energy capacity to utilities for consumption during various case scenarios including back-ups, increase in demand, forecasted time periods, et cetera to ensure reliable supply for long term. This market operates in parallel to balancing markets, and has less relevance to Flexitranstore project, but is touched upon in this section for the benefit of potential investors. Revenue realization is

based on price discovered in auctions held for future delivery periods and utilities compensates for bought capacity on monthly basis during the delivery period.

Cost Structure - For energy storage, capital expenditure includes storage and ancillary equipment, land and facility development, grid connection, and cost of permits. Opex includes cost of finance (debt / equity) and O&M costs.

1.4.2 RES + Storage

Business model to be explored for a hybrid renewable based plant integrated with battery storage to provide flexibility services, linked to Demonstration 2 – WP6. Business canvas on above lines has been elaborated for said business model in the detailed report.

1.4.3 SO + Storage

Business model to be explored for a system operator (either DSO / TSO) connected storage to provide flexibility services, linked to Demonstration 1 – WP5. Business canvas on above lines has been elaborated for said business model in the detailed report.

1.5 Conclusions

Energy storage-based business models for providing flexibility services have emerged in the energy business ecosystem. Investors need to be smart about increasing their revenues and returns by using the right mix of storage technology and target flexibility services.

However, considering the ambition of integrating high RES generation in coming decades, the market for flexibility services is expected to compound and witness exponential growth. Market players are faced with a choice to either enter the market as early entrants to try maximizing their returns with stronger positioning in future, or enter the market late with certain revenue models but equal challenge from competition.

This report uniquely has classified trending business models on a global scale. It is now under the objective of this report to further illustrate detailed business cases for above identified business models. The report in its final version will also aim to provide a commercial tool for storage-based projects to calculate project payback periods and internal rate of returns.

Flexibility is the need of next hour, clocking soon. Storage is on the brink of causing disruption in energy industry. Supported by a market ecosystem, and amalgamating both these services, a strong scalable business is in making.