European Association for Storage of Energy

Services to Support Distribution Infrastructure

Energy Storage Applications Forms

Brussels, August 2021

EASE would like to thank the Technology and Value Assessment Committee Task Force on Segmentation of Applications, led by Jean-Michel Durand (EASE Technical Advisor), for preparing this paper.

Introduction

This overview provides a summary of the different energy storage applications, focused mainly on the electricity system, in order to illustrate the many services that energy storage can provide. The forms are organised according to the segment of the energy system that benefits from a given service; this categorisation does not necessarily reflect the location in which the storage device is installed. The terms for individual services, as well as their maturity (existing service vs emerging or future service) varies across different EU Member States.

The services to support distribution infrastructure include applications storage can provide as an alternative or complement to traditional grid infrastructure at the distribution level. Many services are currently considered 'emerging services', meaning they do not exist in many EU markets today. However, we can expect that as more variable renewable energy sources are deployed (many of which are connected at distribution grid level), the importance of these services will grow.

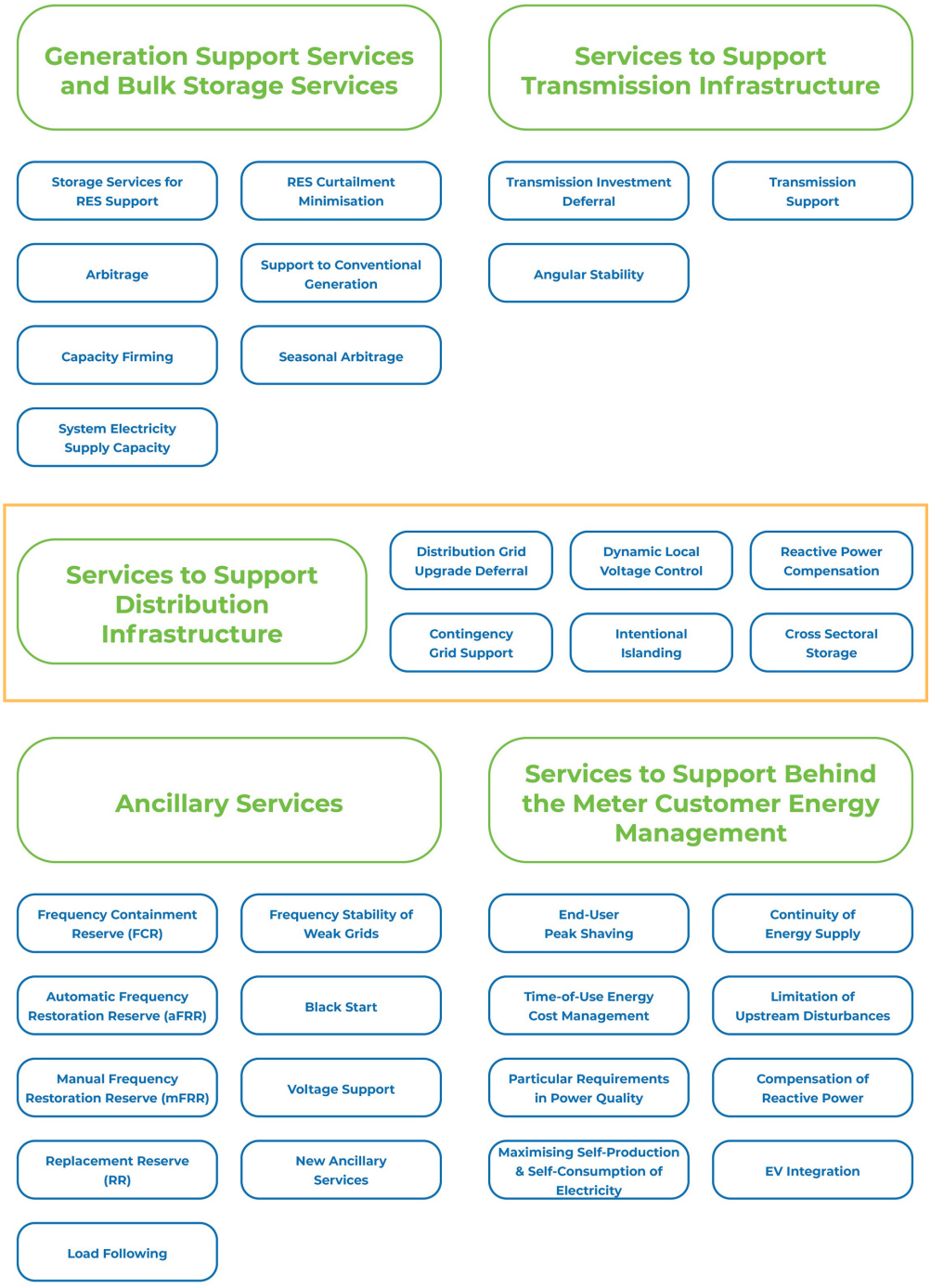

Table of Contents

Technology	Distribution Grid Upgrade Deferral	Contingency Grid Support	Dynamic Local Voltage Control	Intentional Islanding	Reactive Power Compensation	Cross Sectoral Storage
Classical batteries	X	X	X	X	X	
Flow batteries	X	X	X	X	X	
PHS		X	X		X	
LAES	X	X	X		X	
CAES			X			
P2H						X
ThCES						X

Abbreviations

List of abbreviations used in this form:

- **CAES:** Compressed Air Energy Storage
- **DSO:** Distribution System Operator
- **ES:** Energy Storage
- **LAES:** Liquid Air Energy Storage
- **P2G: P**ower-to-Gas Storage
- **P2H: P**ower-to-Heat Storage
- **P2L: P**ower-to-Liquid
- **PHS:** Pumped Hydro Storage
- **TSO:** Transmission System Operator

1. Distribution Grid Upgrade Deferral

Existing Application

1. Definition

The objectives are:

- To use energy storage to defer or avoid distribution infrastructure upgrades and solve distribution congestion issues by installing energy storage systems instead of new lines.
- To use energy storage as a distribution grid component in order to decrease the “traditional” grid size during the grid planning process by basing its design on a medium power value and not a peak power value.

2. Technical characteristics

- ES size range: 500 kW → 10 MW
- Target discharge duration range: 1 → 4 h
- Minimum Cycles/Year: 50
- Ramp-up: ≤ few seconds

3. Application providers

- ES operator
- DSOs

4. Application beneficiaries

- DSOs

5. Market value of the application

- The n-year distribution upgrade deferral value is related to the DSO savings when it defers a distribution upgrade investment for n years.

6. Application synergies for stacking

- Electric Supply Capacity
- Voltage Support
- Capacity Firming
- Load Following

7. Potential energy storage technologies

- Electrochemical: Classical & flow batteries
- Mechanical: LAES

2. Contingency Grid Support

Existing Application

1. Definition

The objective is to use energy storage to perform some capacity/voltage support in order to reduce the impacts of the loss of a major grid component.

It refers to redundancy provisions to cover the trip of the largest transmission line in an area.

2. Technical characteristics

- ES size range: 10kW → few 100kW (LV); 100kW → few MW (MV)
- Target discharge duration range: 2 → 10 h
- Minimum Cycles/Year: Exceptional
- Ramp-up: <30 mins maximum

3. Application providers

- ES operator
- DSO's

4. Application beneficiaries

- DSO's

5. Market value of the application

- The need for flexibility under the unplanned interruptions use case will be infrequent and difficult to forecast. Consequently, this kind of flexibility product is likely to be procured based on a utilisation payment mechanism with contracted utilisation prices.

6. Application synergies for stacking

- Electric supply capacity

7. Potential energy storage technologies

- Electrochemical: Classical & Flow batteries
- Mechanical: LAES, PHS

3. Dynamic Local Voltage Control

Existing Service

1. Definition
Use energy storage to maintain the voltage profile within admissible contractual/regulatory limits.

2. Technical characteristics
- ES size range: 100kW (kvar) → few MW (Mvar) at MV level, 10kW (kvar) → few 100kW (kvar) at the LV level
- Target Discharge duration range: 2 → 10 h
- Minimum Cycles/Year: Occasional (peaks)
- Ramp-up: ≤ 5 min

3. Application providers
- ES operator
- DSOs

4. Application beneficiaries
- DSOs

5. Market value of the application
- The main benefit derives from the deferral of distribution upgrades that would otherwise have been necessary to meet the voltage level requirements.

6. Application synergies for stacking
- Distribution upgrade deferral
- Capacity firming
- Renewable energy time shift

7. Potential energy storage technologies
- Electrochemical: Classical & Flow batteries
- Mechanical: PHS, CAES, LAES

4. Intentional Islanding

Existing Service

1. Definition

Use of energy storage to energise a non-loopable feeder during an outage.

2. Technical characteristics

- ES size range: 10kW → 1MW (LV); 100kW → 10MW (MV)
- Target discharge duration range: 4 → 10 h
- Minimum Cycles/Year: Under exceptional circumstances
- Ramp-up: ≤ 20 ms

3. Application providers

- ES operator
- DSOs

4. Application beneficiaries

- DSOs

5. Market value of the application

- Black-out restoration

6. Potential energy storage technologies

- Electrochemical: Classical & Flow batteries

5. Reactive Power Compensation

Existing Service

1. Definition

Use energy storage to reduce the amount of reactive energy drawn from transmission and charged by the TSO to the DSO.

2. Technical characteristics

- ES size range: few 100kvar → few Mvar
- Target discharge duration range: N/A
- Minimum Cycles/Year: Daily
- Ramp-up: ≤ few minutes

3. Application providers

- ES operator
- DSO's
- Load owners

4. Application beneficiaries

- DSO's
- TSO's

5. Market value of the application

- Grid investment avoidance

6. Potential energy storage technologies

- Electrochemical: Classical & Flow batteries
- Mechanical: LAES, PHS

6. Cross Sectoral Storage

Emerging Application

1. Definition

Practice of coupling the electricity sector with other energy sectors (gas, fuel, heat) by converting excess supply of electricity to the grid into energy carriers, synthetic fuels, and heat, thus avoiding curtailment of running power generators (RES, thermal power plants, etc.).

2. Technical characteristics

- ES size range: > 10 MWel /decentralized), >100MWel (centralized)
- Target Discharge duration range: days → weeks, month
- Minimum Cycles/Year: n.a. (no re-conversion)
- Ramp-up/down: < 10 minutes

3. Application providers

- ES operator
- Power Plant operator that includes P2X possibility

4. Application beneficiaries

- Electricity market
- Other Energy sectors markets
- Mobility sector with the Clean Vehicles development: H2, SNG, etc.

5. Market value of the application

- Wholesale price spread between the Energy vector price and its production cost based on electricity purchase.

6. Application synergies for stacking

- Demand side management
- T&D investment deferral

7. Potential energy storage technologies

- Chemical: P2H (ATES, other large-scale underground TES technologies)/P2G/P2L
- Thermal: P2H (hot water in porous rocks underground or ponds covered by insulation), ThCES

***

About EASE:

The European Association for Storage of Energy (EASE) is the leading member - supported association representing organisations active across the entire energy storage value chain. EASE supports the deployment of energy storage to further the cost-effective transition to a resilient, carbon-neutral, and secure energy system. Together, EASE members have significant expertise across all major storage technologies and applications. This allows us to generate new ideas and policy recommendations that are essential to build a regulatory framework that is supportive of storage.

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

***

Disclaimer:

This content 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.

***

Policy Contact: Susan Taylor | Energy Storage Analyst |
| s.taylor@ease-storage.eu |+32 (0)2 743 29 82

Avenue Adolphe Lacomblé 59/8
1030 Brussels | Belgium
Tel: +32.2.743.29.82
@EASE_ES

www.ease-storage.eu
info@ease-storage.eu