Position Paper: KPI for Energy Storage Systems -Completed by end of March 2022.

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# Executive summary​

# Introduction

* Today’s situation in Europe and requirements for a decarbonized, reliable, adaptable resilient, sustainable, and integrated energy system.
* Source and references: IP ETIP-SNET, Eu green Deal, Clean energy for all Europeans” package, Contribution to Sustainable Development Goals
* Focus on ETIP SNET R&I Roadmap 2020-2030
* Focus on storage and WG2 role and activities

# Scope of the document

Provide stakeholders with the data, tools, and analysis to make informed decisions on EU R&I efforts on energy storage technologies. Focus on performance targets and set of the metric to track progresses.

Focusing on technology development, with an overview on the manufacturing and supply chain constrain and regulatory barriers and gaps

# Storage technologies

Short introduction

# Performance Goals

## Definition

Energy storage performance goals are here suggested. The idea is to identify critical performance aspects that may likely be a solution for Use Case needs supplying the metric to measure such advancements through the appropriate KPI.

* Load response – able to respond to frequency needs of the grid or user. Here are proposed three classifications of load response:
	+ Short-duration – able to respond to shifting capacity needs of the grid or user over second or minutes
	+ Mid-duration – able to respond to shifting capacity needs of the grid or user over the course of a few (1–18) hours
	+ Long-duration – able to provide services over several days or weeks to meet needs of grid or user
* Power quality – provides smooth electricity supply without variations in voltage, frequency, harmonics, unexpected interruptions of any duration, etc.
* Reliable – can provide power, even after long inactive periods.
* Robust – able to withstand extreme use conditions (mechanical distress, cold temperatures, extreme weather) and not fail.
* Long lifetime – able to perform storage services for long time (e.g. in the context of extending storage lifetimes to match renewable power purchase agreements terms until e.g. <20 % capacity degradation).
* Scalable – to cost-effectively build large-scale (e.g. MW) systems.
* Compact – has the energy and power density to cost effectively meet requirements for systems with size and weight restrictions
* Safe – presents low or no safety risks either in operation or in end-of-life disposal/recycling stages.
* Efficient – achieves a high enough conversion efficiency to cost-effectively integrate with necessary energy sources.
* High material efficiency. Raw materials requirement in the design, manufacturing, use and end-of-life stages aiming at the reduction of material demand and usage of critical material. Opportunities for a sustainable end-of-life management (remanufacturing, reuse, repurposing and recyclability)
* Flexible – able to easily integrate and operate with existing generation systems and infrastructure (boundary constraints assessment)
* Modular – can be configured to easily combine with other storage systems to achieve precise capacity targets (“plug-n-play”).

## Mapping and table methodology

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### Importance of Performance Goals to the Use Cases

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### Likelihood to achieve the Performance Goals through specific technologies

…

### Relevance of KPIs and metric for the performance Goals assessment

The Goals must be supported by quantitative, ambitious, and realistic targets. KPIs definition and description. Link with Performance Goals metrics and setting of performance targets

## Proposed targets timeframe

2025 - ETIP SNET Implementation Plan

# Proposed target by energy storage technology

…

# Pump Hydropower

## Short description of the technology

…

## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# CAES

## Short description of the technology

…

## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Flywheels

## Short description of the technology

…

## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Electric

## Short description of the technology

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## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Electromagnetical

## Short description of the technology

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## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Chemical

## Short description of the technology

…

## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Thermal

## Short description of the technology

…

## Challenges (technical and economical) and outlook

Lowest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to overcome them? How?

## Advantages and strong position

Highest score in PG table at *Likelihood to achieve the Performance Goals through specific technologies*

Any chance to improve it or maintain?

## EU and National R&I projects and pilots

## Proposed target KPI

# Conclusions

# References