Energy Storage Technology Collaboration Programme

NOTIONAL LIST OF ACTIVITIES OF THE ES TCP FOR THE FURTHER TERM 2021 - 2026

Preamble

- At the meeting on November 6th, 2019 the Energy Storage TCP Executive Committee made a principle decision to anticipate an extension of the Implementing Agreement for a Programme of Research and Development on Energy Conservation through Energy Storage ("Energy Storage TCP") for the period March 2021 -March 2026.
- The Energy Storage TCP Executive Committee has discussed the strategic priorities for the upcoming extension period in a dedicated workshop during their meeting on May 18th, 2020 and agreed on this outline of the strategic priorities for the new term 2021-2026.

Definition of Energy Storage

An energy storage system can take up energy and deliver it at another point in time. The storage process itself consists of three stages: charging, storage and discharging. After the discharging step, storage system can be charged again.

Basis for our Strategic Priorities 2021-2026

The objective of the Paris Climate Change Agreement 2015 to tackle climate change by transforming into a carbon neutral energy system by 2050, using mainly renewable energy sources, will require huge amounts of energy storage in all sorts and capacities in order to provide the essential flexibility in the energy system. The challenges in this transformation, including its intermediate goals, are to provide carbon-free energy at the right place and time. Electricity moves to the heart of modern energy security. Global needs for flexibility will double to 2040 (IEA report, July 2020), requiring new market designs in order to invite adequate investments in networks, demand-side response, and energy storage also to facilitate energy conservation.
Flexibility between time of use and time of (variable) renewable energy production as well as interaction between sectors (sector coupling) is required for a stable carbon free energy system.

Simultaneously energy efficiency (in particular in industry) provides opportunities to incorporate energy storage in demand side energy reductions and reduce primary energy consumption. Within sectors there will be, to a large extend, a shift in energy sources (i.e. industry from oil/gas to heat and electricity, mobility from fuels to electricity, heating and cooling in building etc). Furthermore, (renewable) energy production will be more decentralized compared to our traditional energy system requiring digitalization to facilitate that transition. Energy efficiency and renewable generation calls for more energy storage and fuel shifting (electric vehicles, power2heat, powe2hydrogen, etc) provides new applications for energy storage. The significance of energy store overarches energy production; it has an impact on the entire energy system. All these developments require all sorts of energy storage and this will provide new opportunities for a further upscaling of energy storage. The use of storage will improve conditions to meet various times of needs (e.g. integration of renewables, frequency regulation, alleviation of the congestion in distribution systems) and will differ in size, response time, capacities and application area (like electrical, thermal cold and heat, sector coupling, fuel switches, etc). There can be storage solutions at a large scale (such as pumped hydro or the conversion of surplus electricity into hydrogen) or more decentralized thermal or electricity energy storage solutions in the build environment, industry and mobility sector; all will be needed.

In this respect, the "value" of energy storage has gradually become more recognized, both in terms of monetary and technical value. This leads to increased flexibility and stability of the future energy system, and also improves the potential of energy conservation and economic viable solutions.

A growing scientific and political interest in energy storage is evident. This is recently illustrated by the EC's proposed recovery strategy where energy storage is an explicit and prominent part (see also: https://ec.europa.eu/info/sites/info/files/communication-europe-moment-repair-prepare-next-generation.pdf)
International organizations play an increasingly important role in deploying and disseminating information on energy storage and the effects of Covid-19 may influence the speed of the energy transition. All this drives the need for more and improved storage solutions. The ES TCP contributes through international collaboration to this need by further research, development and effective deployment of energy storage.

These considerations are the basis for our **Mission:** ***Energy Storage contributes and provides solutions for the challenge to tackle climate change and the transformation to a circular economy.***

Challenges for energy storage

The main challenges for the development of energy storages include:

- Facilitating demand side management and optimize energy grid infrastructure;
- Improving asset value and contribute to security of supply;
- Maximizing (volatile) renewable energy production to match to various demand profiles;
- Facilitating sector coupling (coupling various sectors, i.e. electricity, gas, heat and cold, mobility);
- Anticipating on developments toward a more decentralized energy system, IoT, AI, circular economy, LCA and end of life aspects;
- Investigate appropriate business models (taking pricing mechanism into account) and updating regulatory frameworks;
- Facilitating bi-directional and demand-side response applications;
- Technical and innovative challenges like compactness, charging / discharging capacities, safety aspects, reliability / durability and cost reduction.

Priorities for energy storage

These challenges are the basis for the following **priority areas**:

1. **System integration:** Energy storage enabling flexibility and sector coupling, including bi-directional applications and focus on more integrated system packages
2. **Electrical Storage**: focus on system aspects of electrical storage and new and innovative storage concepts
3. **Thermal Storage:** focus on thermo-chemical / thermo-physical, Phase Change Materials (PCM), sensible thermal storage (at all temperatures ranges and serving various applications)
4. **Hybrid Options:** focus on power to heat (P2H), power to gas (P2G- within boundaries of gas/H_2 as energy storage and carrier/vector serving system integration) and specific conversion technologies, efficiencies, etc

In the table below the current Annexes and their scope are linked to the identified Priority Areas.

Current Annex	Topic	Priority Areas: System Integration	Electrical Storage	Thermal Storage	Hybrid Options
32	Modelling of Energy Storage for Simulation/ Optimization of Energy Systems	■	■	■	
33	Material and Component Development for Thermal Energy Storage			■	
34	Energy storage with heat pumps', a.k.a. Comfort & Climate Box	■		■	
35	Flexible Sector Coupling by the Implementation of Energy Storage	■			■
36	Carnot Batteries		■		
37	Smart Design and Control of Energy Storage Systems	■	■	■	
38	Ground Source De-Icing and Snow Melting Systems for Infrastructure			■	
39	Large Thermal Energy Storages for District Heating			■	■
	Extra emphasis for scope in new Annexes in next term	■			■

Policy Priorities

In the past energy storage was mainly considered as a technological option, however today we need to position energy storage as an economic parameter in the energy transition. There is a need to contribute with background knowledge on various aspects, which can serve to develop the regulatory framework for better use of energy storage. The IEA can build on the ES TCP work to include the impact of the various storage technologies in their scenario's in order to have a clear picture of policy priorities.

This will require improved partnerships between other international bodies (like UN, World bank, MI, CEM, IDO, CEN) and affiliated initiatives (like other TCP's). The policy message should emphasize the value of energy storage as major contributor to CO_2 reduction technologies and energy transition. We will seek better and more convincing exposure and visibility of the impact energy storage will have on the energy ecosystem and demand side. Furthermore, there is a need to establish an analytical regime of metrics for valuing energy storage across energy technologies, end use profiles and jurisdictions. This requires improved communication efforts such as better visualization, successful demonstration projects and show case applications, simpler language and communication of results of ES TCP work in our networks.

Guiding principles for communication, cooperation, education and deployment

It is recognized that TCP resources are limited. However, efforts will be made to increase the dissemination of the TCP work results. Results will be open source and shared through public media.

Our goal is to become the leading international source for energy storage information by establishing a public database on our website for successful storage system applications, demonstration projects and lessons learned. Thereto we will seek strong and continuous cooperation with other databases and information sources.

Special attention will be given to any new Annex to actively stimulate industry involvement in order to effectively increase and accelerate the deployment of innovative developments.

The tri-annual scientific Energy Storage conferences ("Enerstock- conference") continues to be the platform for sharing latest results in the scientific community. We will use and promote the "ES TCP" and "Enerstock" brand for better recognition. Other communication efforts are directed to support our policy messages and to increase the active participation of experts from the "energy storage community" in symposia, workshops, webinar events, etc. to present the latest developments and innovations on energy storage.

TCP Modernization

Following the April 2020 decision of the IEA Governing Board approving the *Framework for the Technology Collaboration Programme,* the TCP will discuss the first version of the proposed amendments to update the Implementing Agreement in the fall of 2020. The draft of the amended version is on the agenda for the November 2020 ExCo meeting. We aim and concluding this modernization process early 2021, at latest during the Spring ExCo meeting 2021. Some of the modernization changes like the Limited Sponsor model and 3rd party invitation for singles tasks are very much welcomed and most likely could already be implemented in new Annexes.