STORAGE RESEARCH INFRASTRUCTURE ECO-SYSTEM

D3.7 – "Education Programme rules and procedures"

Work Package 3 - Enabling breakthrough research and innovation across the whole value chain

Task 3.4 - Education, training, and international mobility

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DISCLAIMER

ABBREVIATIONS AND ACRONYMS

EPMC	Education Programme Management Committee
ES	Energy Storage
GCSP	Grand Challenges Scholars Program
TP SC	Training Programme Steering Committee

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1. INTRODUCTION

This deliverable regards Task 3.4, which main aim is to create and empower a new generation of researchers and technologists with holistic competences embracing technical, environmental, economic, and social aspects of Energy Storage (ES) technologies, systems, and hybridisation, and promote knowledge sharing between research and industry through courses and training for the existing and upcoming workforce.

The task is divided into three subtasks as introduced below. Each of the subtask will be further detailed in later sections.

1.1. Subtask 3.4.1: Establishing, developing, and monitoring education, training, and international mobility

The objective of this subtask is the development of the education and training programme within StoRIES for the benefit of scientists and technologists in its ecosystem and the EU. An Education Programme Management Committee (EPMC, KIT as chair), established within the StoRIES community, will decide on the rules and procedures of the task and define and monitor the education, training and international mobility actions.

StoRIES EMPC, presented in Table 1, includes representatives of the StoRIES beneficiaries who actively contribute to the development of the programme. The representatives from each beneficiary may change during the project execution.

Table 1: Members of the Education Programme Management Committee of StoRIES

Organisation	Name
KIT	Stefano Passerini Holger Ihssen Myriam Gil Bardaji Olga Sumińska- Ebersoldt
CIEMAT	Marcos Lafoz
CNR	Marco Ferraro
DTU	Peter Holtappels
UNIPG	Linda Barelli

1.2. Subtask 3.4.2: Training and Education Actions

The actions will provide knowledge on ES technologies, hybridisation, sustainability, and impact aspects, as well as guidance to understand stakeholders' needs to identify future challenges and needs of ES as an integral part of the energy system. The scientific content will be worked out by EPMC based on input from WP1, WP2, WP3 and WP4 as well as feedback from participants and stakeholders in the StoRIES eco-system. The promotion and publication of the results will be positioned on the StoRIES website. The following actions will be targeted:

- **Training Programme for University Master's students** aiming at multiple competences. This training will benefit from the link to the Grand Challenges Scholar Programme (GCSP) offered by University of Perugia (EERA LTP)
- **Mentoring Programme for PhD students dealing with hybrid ES**

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- Annual **Summer Schools for young scientists** starting in the second year of the project in physical or virtual form depending on the participant preferences
- Annual **online courses for workforce from academia and industry**
- An **online platform with existing online open academic courses on ES**.

1.3. Subtask 3.4.3: International Research Exchanges

The objective of this subtask is to foster collaboration between European and international laboratories and offer European researchers access to world leading international research infrastructures. Researchers from institutions located in the EU or countries associated to Horizon Europe can visit laboratories located in non-European countries or European countries not participating in the Horizon Europe programme.

Five calls at M12, 18, 24, 30 and 36 will be opened inviting proposals for international researcher exchange. The aims of the research exchanges are (i) improve the researcher’s skills in the topic of energy storage increasing their experience related to energy storage technologies; (ii) use of experimental facilities where energy storage is involved; and (iii) activities related to the energy management with energy storage.

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2. TRAINING PROGRAMME FOR UNIVERSITY MASTER'S STUDENTS

Within the StoRIES project, two different targets are pursued, short and long-term, the latter producing an after-project impact.

Both targets are devoted to University Master's Students in the **STEAM (Science, Technology, Engineering, Arts and Maths) field**, especially involving ES improvement and implementation towards the clean energy transition. The targets answer the need indicated by the CETP – SRIA[1] of a **challenge-driven interdisciplinary and multi-level approach**, supported by collaborations and synergies with a strong **trans-national character.**

The proposed initiatives will train individual students to achieve an interdisciplinary competence with attention also to environmental, economic, and social awareness issues, enabling future engineers and researchers to pursue the challenge-driven approach. The high number of research infrastructure providers and partners involved in StoRIES, representing 17 countries, offer an international experience to students, which are trained to operate within transnational teams. The StoRIES community enables the realization of two different targets toward the education of University Master Students.

- Target 1: During the StoRIES project, a *Master Student Training Programme* will be developed and implemented. The Programme will provide the opportunity for students working on energy storage to get additional knowledge and skills necessary for deeper understanding of the hybrid energy storage and its influence on the technical, economic, social, and environmental surrounding.
- Target 2: The long-term Target focusing on planning and preparing a *Master Course on Energy Storage: Hybridization and Integration in Sustainable Energy Systems.* The idea and construction of such course will based on experiences from the Master programmes of InnoEnergy, ALISTORE, and POLYSTORAGE, and will be realized after or in the ending phase of StoRIES depending on the availability of funding.

Although the proposed Target 1 in the Training Programme is not required to be formally recognized by the Universities, they will be invited to use the contents of this Training Programme as the basis to develop their own official courses on the topic of Energy Storage (Hybridization), as a complete University Course or integrated in existing courses (Target 2).

TARGET 1	DEVELOPMENT AND IMPLEMENTATION OF A **MASTER STUDENT TRAINING PROGRAMME** contributing to enlarge students' competences DURING THE THESIS PERIOD
Training programme design:	The first target consists in the design and implementation of a Training Programme (TP) based on a mentorship model offered over voluntary basis. Involved Universities are invited to mentor the students attending the Programme, over a specific ***Challenging Scientific and Technological Topic*** (Section 2.1.1) to achieve the ***Training Objective*** (Section 2.1.2).

[1] Integrated SET Plan CETP - Clean Energy Transition Partnership - Strategic Research and Innovation Agenda (v1.0 Endorsed by European Countries and the European Commission) - November 2020

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Training programme implementation:	In M7 the TP Steering Committee will be established with University of Perugia being in charge. Between M7 and M12 the guidelines will be defined and in M12 delivered to the StoRIES Steering Committee and Governing Board for consultations and approval. In M14 the Programme will be opened and the offer for the students will be published online. In M24 the offer will be readjusted according to the needs and possibilities. In M36 the last adjustment will be performed.
Description:	The TP is mainly based on the Mentors' activity, who will monitor and assess the achievement of training objectives by the students, and on local coordinators who trace the outcomes of students' activity at each University. No degree title is delivered. This allows to skip the long administrative procedures to implement a Master Course delivering a degree title recognized by multiple Universities, thus enabling the TP in the short term, i.e., impacting within the StoRIES duration. The vision, methodology, and targets that inspire such a TP are detailed in the guidelines (see Section 2.1.3).
TARGET 2	DEVELOPMENT of a MASTER COURSE on ***ENERGY STORAGE: HYBRIDIZATION AND INTEGATION IN SUSTAINABLE ENERGY SYSTEM***
Training programme design:	One of the goals of StoRIES is to build a group of researchers and engineers capable of successfully addressing the technical and non-technical challenging aspects of hybrid energy storage. To achieve this goal, StoRIES will plan and prepare the structure of the Master's course within its consortium, which will focus on StoRIES ES hybridization objective. The course will be based on the master programme concepts developed in InnoEnergy, ALISTORE and POLYSTORAGE. The universities, research organisations, and industrial partners of StoRIES will form the core of the course and define the rules, procedures and topics of the lectures, but will also look for external partners to join the initiative.
Training programme implementation:	In agreement with TP Steering Committee, EPMC will propose by M24 the structure, rules, requirements, and a plan of implementation to the StoRIES Steering Committee for comments and approval. Initial ideas for the course are presented below in 'Description' and in Section 2.2. By M27, a list of internal and external organisations that support this initiative actively will be established and funding opportunities will be sought. The course will be launched, possibly, before the end of StoRIES if appropriate funding will become available.
Description:	The Master Programme is initially planned for 2 years consisting of: • 4 courses and • 1 semester at research organisation and/or 1 semester at industry. The courses will include the aspects of the complexity of energy system and the importance of the energy storage in it under consideration of the cost and sustainability. Various energy storage technologies will be presented, their application and the hybridization of the technologies providing solutions to specific targets. Furthermore, the social aspects and the communication with the stakeholders will be addressed.

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2.1. Target 1: StoRIES Master Student Training Programme

The StoRIES TP aims to create and empower a new generation of researchers and technologists with holistic competences embracing technical, environmental, economic, and social aspects of ES technologies, their hybridization and integration to address breakthrough research and innovation in support of the European Green Deal.

Specific goals of StoRIES TP for University Master's Students are to:

- ✓ Stimulate students dealing with ES toward an integrated approach acquiring inter-disciplines competence, with attention to economic and social awareness issues. In our vision that prioritize academic excellence, social engagement, and global impact, students are trained to a such global competence, required to pursue positions and/or careers that can help solve the challenges of future energy systems
- ✓ Build community amongst the entities working on ES through networking events with students and senior scientists
- ✓ Raise awareness of the energy storage needs in general University community and specifically for aspiring technologists at the start of their careers

To these aims, StoRIES TP identifies specific ***Challenging Scientific and Technological Topics*** (Section 2.1.1) over which students are trained to achieve the StoRIES ***Training Objective*** (Section 2.1.2).

2.1.1. Challenging Scientific and Technological Topics

The students attending the StoRIES TP have to face with the following topics identified as the ones of greatest relevance to boost the Clean Energy Transitions:

- ✓ Development of new materials for energy storage devices
- ✓ Hybridization in the energy storage field at the materials level
- ✓ Hybridization in the energy storage field at the component/device level
- ✓ Innovative Energy carriers and related technologies for production/utilization
- ✓ Energy Storage Integration in multi-energy eco-systems
- ✓ Sustainability of the hybrid energy storage solutions

2.1.2. Training Objective

The Training Objective consists in the achievement, over a specific topic, of a knowledge including the following components:

- ✓ **Technical**: mentored research investigation on a **challenging scientific or technological topic** (it may include working experience at the infrastructure of RI providers within StoRIES)
- ✓ **Interdisciplinary and multi-level approach**: the student follows a multidisciplinary approach as needed by a challenge-driven study, understanding the multi-level (from materials-to component and systems) aspects of systems solutions developed
- ✓ **Environmental**: the students are trained toward sustainable solutions and to assess environmental benefits provided by the implementation of developed solutions, and also including sustainability assessments covering the full life-cycle of the developed solutions

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- ✓ **Economic**: the student is trained to consider the economic aspects in the solutions development since a viable business model is needed for their implementation
- ✓ **Social**: the student is trained to consider social acceptance aspects in the solutions development and/or social impact of the developed solutions

2.1.3. Implementation and management

The Chapter describes the initial idea of the structure and the guidelines for the TP, which will be corrected and elaborated by the TP Steering Committee by the M12.

TP Steering Committee

The TP Steering Committee (TP SC), established in M7, will be composed of members having expertise and direct contact to the universities belonging to the StoRIES community. For this reason, each member of the TP Steering Committee acts as a TP local coordinator at one of the Universities involved in the TP and belonging to the StoRIES community.

TP SC will prepare and monitor the Training Programme, starting from the planning of the training according to the below described methodology in M7.

TP SC will be responsible for the ongoing operation and assessment of the program including recruiting, processing applications, monitoring, disseminating and evaluation of the program. Also, reviewing of student's applications and monitoring of student progress are provided by TP SC thanks to a direct interface with scholars' mentors. TP SC is also in charge of asking providers of Research Infrastructure and partners for the availability for student visiting on specific topics and of the continuous update of the related published information.

The TP SC Chair (University of Perugia) is responsible for leading the program and chairing the group, and beyond that coordinating the activity of the TP local coordinators. The Chair is also responsible for compiling, based on data provided by local coordinators, the names and accomplishments of students who receive the StoRIES 'TP' designation upon graduation and reporting this information to the StoRIES Steering Committee.

The Chair is responsible for the overall administration, operation, assessment, and reporting. Operational duties will include program logistics, scholar selection and monitoring progress of scholars.

University local coordinator

At each involved University a TP local coordinator, member of the TP SC, informs his/her colleagues (potential mentors of students) about the TP and related activities offered to students by the StoRIES project (visiting students at excellence Research Infrastructure providers, seminars, summer schools).

Moreover, the TP local coordinator promotes the TP among students. The TP local coordinator is responsible for communicating with the scholars' mentors. The TP local coordinator is also responsible

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for compiling the names and accomplishments of students who complete the StoRIES training programme and to communicate these data to the TP SC Chair.

University mentorship

The TP implementation is based on a mentorship model over a voluntary basis.

Involved Universities are invited to mentor the students attending the Training Programme. Mentors supervise students to achieve the ***Training Objectives*** supporting them in:

- ✓ addressing all the technical aspects;
- ✓ identifying connections between technical research and non-technical components that make the difference between researching and actually solving a ***Challenging Scientific and Technological Topic***;
- ✓ working with students to incorporate and satisfy the requirements regarding the non-technical aspects;
- ✓ reporting the activities performed to satisfy at least the ***Minimum Requirements*** that students have to achieve during the TP, and their findings regarding all the goals of the ***Training Objective***;
- ✓ editing and reviewing student deliverables for each of the relevant knowledge component of the ***Training Objective***

Assessment duties include assessment of attainment of learning outcomes for the program. Mentors are the only to assess ***if*** and ***when*** students achieve the Training Objective.

Training methodology

Curricular programs are integrated with extra-curricular training experiences (*most likely during the thesis work*) on multi-components (technical and non-technical) that are designed to prepare students to be the generation solving the challenges of the clean energy transition.

Each student will engage in the technical issue at a high level of depth, in the non-technical aspects at medium levels of depth, being the selected Challenging Scientific and Technological Topic (among the ones identified in Section 2.1.1) the focus of all the components.

Offer for the students

Students attend the program on a voluntary basis to perform their thesis job according to the guidelines of this TP. To support students in this choice the TP SC could institute some scholarships. It is not required that universities formally recognized the TP, no specific degree titles are delivered. This is similar to what happens for the Grand Challenges Scholars Program (GCSP).

The offer includes specific seminars and summer schools through which the students can extend their knowledge in both technical and non-technical components. Moreover, also the opportunity of visiting

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periods at the Research Infrastructure providers and other entities belonging to the StoRIES community is included for deep investigations of specific aspects.

Mentors support students to identify the more suitable activities, among the ones offered by the TP but not limited to these ones, to satisfy the requirements that they must achieve.

Process and documents

The detailed process definition and documentation will be prepared at M12 by TP SC.

Minimum requirements

Minimum requirements that students have to achieve during the program, i.e. extracurricular activities/experiences performed to achieve the Training Objective are:

- participation to seminars - including (but not exclusively) the ones organized within StoRIES also focused as example on economic, social, environmental issues, innovation managing/patenting, as well as scientific communication
- participation to summer schools including (but not exclusively) those organized within StoRIES
- activity at research laboratories of StoRIES Research Infrastructure providers and partners
- Other specific activities possibly identified by the Mentors.

Minimum requirements are established by Mentors according to the specific training path of each student to achieve the Training Objective.

Recruiting

The detailed process and rules of recruiting will be prepared at M12 by TP SC.

Reporting

Once the TP is completed, students to receive the StoRIES 'TP' designation must deliver a report for each knowledge component according to a specific format:

- ✓ **Technical knowledge**: 1500-3000 words report summarizing the most relevant findings of the mentored research investigation on the selected Challenging topic. Furthermore, the report must indicate the details of the activities performed to achieve such a knowledge, including also technical seminars, summer schools, research experiences at the Research Infrastructure providers/partners belonging to the StoRIES community, or other experiences.
- ✓ **Interdisciplinary and multi-level approach knowledge**: 1000-1500 words report on the multidisciplinary and multi-level approach the student followed to solve the challenge-driven study. The report has also to indicate the activities performed (including attending to seminars, summer schools, conferences, as well as research or other experiences) to achieve this understanding of the investigated phenomena.
- ✓ **Environmental knowledge**: 1000-1500 words report on the environmental implications and impacts of the specific solution the students found to answer the Challenging Topic. The students must demonstrate that environmental issues were considered in the development of the technical solution and its potential use. The details of specific activity (including attending to seminars, summer schools, conferences, as well as research or other experiences) must be included if performed to achieve such a knowledge.

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- ✓ **Economic knowledge**: about 1000 words report on the economic aspects considered in the solutions development and the related assessment on the economic viability. Details of specific activities must be included in the report, if performed to achieve this target
- ✓ **Social knowledge**: about 1000 words report on social acceptance aspects related to the developed solutions (e.g., mitigation solutions adopted in the solution development to increase social acceptance; readiness level or social impact of the developed solutions). Details of specific activities must be included in the report, if performed to achieve this target.

Moreover, it is suggested to organize the thesis to have at least one chapter or section dedicated to each of the knowledge component.

2.2. Target 2: Development of the Master Course on Energy Storage: Hybridization and Integration in Sustainable Energy System

The details of the Course will be prepared by EPMC within M24 and will be discussed with the Universities, Research Organisations and Industry partners interested in the initiative in the second half of the StoRIES project. EPMC have worked out a first example of the course sections/topics:

SECTION I. Introduction and description of the situation in energy systems under renewable energy penetration

- Transmission & Distribution systems (electricity, gas, and heat)
- Energy generation (conventional and renewable power supply)
- Effects produced by Renewable Energies in electric grids
- Energy Storage as solution for the problems at electric grids. Analysis and case studies
- Energy Storage and diverse regional challenges and opportunities
- Overview of Energy Storage Technologies and applications
- Connection of Energy Storage and renewable energies with other energy vectors
- Underground energy storage
- CO2 utilization and storage as part of in the Energy Transition

SECTION II. Electrochemical storage I: Batteries

- From classical batteries to the state of the art in batteries
- Li-ion batteries: concepts and operation principles
- Li-ion batteries: ageing, models, and application
- Application cases and case studies
- Redox flow batteries and its potential application in electric power networks
- Batteries integration and operation in electric power networks
- Characterization and operation issues
- Integration of Batteries with other energy storage approaches

SECTION III. Electrochemical storage II: Ultracapacitors

- Technology description, concepts, and operation principles

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- Types of ultracapacitors
- Comparison with batteries and conventional capacitors
- Integration and operation of supercapacitors in hybrid applications. Power converters

SECTION IV. Chemical storage: H2, P2X and fuel cells

- Hydrogen production and hydrogen as energy carrier
- Materials for hydrogen production and storage
- Implementation of hydrogen: safety and social issues
- Power to X
- Fuel cell – types, operation, and individual components
- Integration with other energy storage approaches

SECTION V. Thermal energy storage

- Heat and mass balances of thermal energy storages
- Thermal ES: technologies, sources of heat and materials
- Thermal energy storage implementation in the building sector and for industrial processes
- Systems and their components for energy storage
- Design and calculation of thermal energy storage systems
- Integration of thermal storage with other energy storage approaches

SECTION VI. Mechanical energy storage

- Pumped hydro energy storage
- Liquid air energy storage
- Compressed air energy storage (CAES)
- Energy storage based on flywheels
- Hybrid storage involving other energy technologies, including multiple mechanical storage approaches

SECTION VII. Magnetic energy storage

- Introduction to superconductivity concept
- Energy storage with superconducting coils (SMES)
- Design of the superconducting coil and cryostat
- Power electronics design for SMES
- Integration with other energy storage approaches

SECTION VIII. Hybrid energy storage

- The concept of hybridization of storage technologies
- Control strategies to integrate several energy storage technologies
- Application of hybrid ES solution for mobility
- Application of hybrid ES solutions for stationary cases
- Case studies analysis

SECTION IX. Grid integration of hybrid energy storage

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- Energy market and energy storage systems
- Energy storage systems needs in energy power networks. Regulation and examples
- Energy storage systems dimensioning and case example of energy storage systems integration in electric power systems
- Socioeconomic and environmental aspects and impacts of energy storage systems
- Sector-coupling strategies for hybrid energy storage systems

SECTION X: Sustainability aspects of hybrid energy storage solutions

- Socio-technical implications
- Environmental Assessments for energy storage, overview of methods and use cases
- Techno-economic evaluation of energy storage technologies

SECTION XI: Project management

- Funding sources for hybrid energy storage research
- Basics of project management for hybrid energy storage
- Student project for project management

A student who has met the objectives of the course will be able to:

- Explain and utilize basic concepts of hybrid energy storage
- Explain the physical and chemical principles of various, but different energy storage and conversion technologies
- Calculate the energy content, power capability and energy losses of storage devices
- Design and implement a quantitative description of key operative and techno-economic characteristics of an energy conversion and storage device
- Describe main production routes for sustainable fuels and chemicals
- Design a sustainable energy system by integrating the right type and scale of energy conversion and storage technologies
- Analyze and compare different system integration scenarios in terms of energy efficiency and cost
- Organize and execute group-based project work
- Communicate technical subjects both orally and in writing
- Evaluate a scientific presentation and give constructive feedback to peers

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3. Mentoring Programme for the PhD Students Dealing with Hybrid Energy Storage

3.1. Objectives

The successful thesis activities, preparing the student for its future work, should include the possibility of networking and getting soft skills, but also knowledge on topics not directly linked to the thesis. With the mentoring programme, StoRIES offers PhD students support of excellent senior researchers and engineers from academia and industry. The students working on hybrid energy storage approaches will receive a great opportunity to meet and discuss their work and its impact and to look at it from a wide point of view.

3.2. Implementation

The possible mentors (from academia and industry) will be contacted in June 2022 by the EPMC and asked for participation in the programme. The list of the mentors with a short description of their work will be published online. The group will be open for new participants during the whole project duration.

In October 2022, a call will be issued for PhD students working on hybrid energy storage to apply for the mentoring programme. Mentor-mentee pairs will be set together by EPMC as needed, i.e., a suitable mentor will be sought according to the following criteria:

- Added value for the mentee in terms of possible knowledge transfer from the mentor
- Possible future collaboration between mentor and mentee after the PhD
- Expected outcome of the collaboration in terms of energy storage hybridisation and implementation of the innovation in the energy system
- Acceptance of the mentor by the tutor of the PhD student

EPMC will endeavour to match the mentor-mentee pair within 3 months from the application. The collaboration between the mentor and mentee established under the StoRIES programme should include the following:

- One face-to-face meeting, if requested. The costs for such a meeting are covered by the StoRIES budget. The doctoral candidate or the mentor will apply for reimbursement before the trip. Depending on the decision of EPMC, a confirmation of reimbursement will be sent, or a refusal will be justified. StoRIES will cover travel, accommodation, and daily expenses for a stay no longer than required for the Mentoring Programme. The number of visits covered will depends on demands and the available budget (14 000€). The last request for reimbursement will be accepted 6 months before the end of StoRIES project
- Regular online meetings every 6 months to discuss the PhD, its progress, challenges and plans for the next 6 months
- Final report at the end of the programme with information about the dissertation, the added value of the programme and a communication flow (meetings) to be confirmed by both parties. The report will be published on the StoRIES website.

The collaboration between the mentor and the mentee must last longer than one year and ends automatically with the end of the PhD study or with the end of the StoRIES project. Even if the formal collaboration and support ends with the StoRIES project, the mentor and mentee are encouraged to continue their collaboration as they see fit.

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4. SUMMER SCHOOLS FOR YOUNG SCIENTISTS

4.1. Objectives

To enable young scientists (Master, PhD students and PostDoc) to get knowledge on the various aspects of hybrid energy storage and its integration in the energy systems, StoRIES will organise three summer schools for young scientists starting in the second year of the project in physical or virtual form depending on the participant preferences.

The summer schools will be organised at the premises of StoRIES partners and will cover a wide thematic scope of energy storage, especially its hybrid aspects. The following topics are examples of what will be included in the teaching programme:

- Introduction to Hybrid Energy Storage Solutions
  - Clean Energy Transition and the need of flexible, clean, and low-cost energy storage solutions
  - Status Quo of energy storage and its hybridisation
  - Sustainability in energy storage
  - Ideas for the future – hybrid materials, devices, systems
- Hybrid energy storage – technology coupling for stationary application
  - Challenges of stationary application
  - Existing hybrid solution, their strengths and weakness
  - Ideas for the future
- Hybrid energy storage – technology coupling for transportation
  - Challenges of mobile application
  - Existing hybrid solution, their strengths and weakness
  - Ideas for the future

4.2. Rules and Procedures

Once a year, starting in 2023, one of StoRIES partners will organise the one-week summer school on site, but also in hybrid mode to favour attendance, with the support of the Task 3.4 leader coordinator.

Participants of the summer schools are students from StoRIES consortium and external organisations. Six months before each Summer School, the event will be advertised on StoRIES website and social media, including StoRIES newsletter. The number of Summer School participants attending in presence will range between 20 and 30. The online/hybrid mode is open and not limited. Students attending the face-to-face summer school will receive a StoRIES certificate confirming their participation.

The speakers of the Summer Schools will come from the StoRIES consortium as well as external organisations providing not only the knowledge, but also enabling the creation of a network for the students (i.e., the future experts) taking part in the Summer Schools.

4.2.1. Summer school planning and content definition

The three StoRIES Summer Schools will be organised and carried out by:

- EPMC (described in Chapter 1)
- The Task Force established for every summer school 6 months before the event. Such Task Force will consist of:
  - two representatives of the partner organising of the event at its promises,
  - one representative of the StoRIES coordinating organisation
  - at least two other EPMC members

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The main tasks of the Task Force are:
  - Finalisation of the agenda
  - Invitation of the speakers
  - Coordination of the registration for the event and the promotion
  - Registration confirmation
  - Organisation of the event at the promises
- StoRIES Steering Committee (described in D6.1) supporting the planning of the schools with its expertise

The summer schools are planned for the months:

- 1st summer school M18-M24 (between Apr and Oct 2023)
- 2nd summer school M30-M36 (between Ap and Oct 2024)
- 3rd summer school M42-M44 (between Apr and Jun 2025)

The organisation of the summer schools will proceed as follows:

- 7 months before the planned summer school, the EPMC agrees with the Steering Community of StoRIES on the date of the summer school
- 6 months before a summer school, the EPMC in agreement with the Steering Community of StoRIES prepares draft of the agenda including the topic and the scope of the school, the sessions' titles, possible speakers, and the promises of the event. The first draft will be promoted on the StoRIES website and social media. 6 months before the event a Task Force will be established for the summer school and will take over the organisation of the event.
- 4 months before the event, the Task Force will present the EPMC the finalised agenda and planning of the summer school. The information will be published online.

4.2.2. Summer school execution

The execution of the summer school starts after publishing the finalised agenda online on the StoRIES website. At the point, the planning phase is finished.

Registration

Depending on the mode of the summer school, the registration for the event will be opened and proceeded in a defined way

- **In presence:** Student Training Programme and Mentoring Programme participants will be favoured and will be able to register in a pre-registration which will be handled per invitation of the EPMC 2 weeks before the official registration opening. The places still available after the pre-registrations will be opened to all online.
- **Hybrid mode** (in presence and online): As in case of the 'in presence', a pre-registration will be opened for the participants of the Student Training Programme and Mentoring Programme for 2 weeks prior the public registration. The still available places will be opened to all. There is no limit planned for the online participation.
- **Online** summer school: The event will be open to all without participant number limitation.

The Task Force will confirm the registration and provide all necessary information to the participants and the speakers about the event.

Summer School in presence – organisation

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The StoRIES partner, at which promises the Summer School takes place (Summer School organisator) is in charge of the Summer School organisation including the room(s) finding for the lectures, providing information on the arrival possibility, hotel preferences, catering, restaurants etc. Task Force supports those tasks if needed.

Every Summer School has a budget of 6 000€ to cover the room fees, catering, certificate cost and possible speaker travel expenses. If the budget is not allocated completely, the difference will be used for the following Summer School.

The Summer School organisator proposes a preliminary budget of the Summer School to the EPMC 3 months prior the meeting for approval and after the meeting presents the costs summary to the EPMC and the StoRIES Steering Committee. KIT holds the money and covers the accepted costs.

Reimbursement for speakers

If requested, StoRIES can cover partially or complete the cost of active participation in the Summer School. The application for the reimbursement must be communicated with the EPMC before the agenda of the Summer School is finalised.

Reimbursement for participants

Due to a limited budget, no reimbursement of the travel costs of the passive participants (students) is possible. However, StoRIES leaves open a possibility of cooperation, which will enable such reimbursement or cost sharing with other initiatives complementing the Summer Schools objectives.

Certificate

Each participant of the summer school receives a digital certificate confirming participation. The certificates will be prepared and distributed by the EPMC within 3 months after the Summer School.

Summer School Report

Within three months after the Summer School, Task Force will prepare a Report summarising the Summer School and submit it to the EMPC and the Stirring Committee for approval. Following point will be included in the Report:

- Objectives and topic(s) of The Summer School
- Agenda
- Participant list
- Financing
- Feedback from the participants
- Comments from the Task Force regarding the organisation and execution

A short version of the report will be published online.

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5. Online Courses for Workforce from Academia and Industry

5.1. Objectives

The development of hybrid energy storage solutions, but also their implementation request researchers and engineers capable to work with it and understand not only the technical aspects of the new technologies, but also see the interrelationships between the technology, the financial and environmental cost, and the social, regional, and political surrounding of the technology.

While chapters 2,3 and 4 focus on the young scientists dealing with the aspect in the near future, this Chapter, describing the Online Courses for Workforce from Academia and Industry, focuses on the existing workforce and the need of its further education with respect to energy storage in the Clean Energy Transition and the changing energy market.

The courses may include the following points:

- Clean Energy Transition and its meaning for the energy market
- Financial cost and environmental cost of an investment in the energy storage
- Life Circle Assessment
- Hybrid Energy Storage (material, device, system)
- Hybrid Energy Storage – requests of transportation
- Hybrid Energy Storage – requests of stationary application
- Hybrid Energy Storage – solutions for industry
- ...

But also, more specific topics, like:

- Thermal energy storage for industry
- Artificial Intelligence in the development of materials for Energy Storage
- Large-scale Metal/air and Metal-water batteries
- The effects of energy storage systems in electric grids with renewable energy penetration
- ...

The topics will be chosen according to the requests from the StoRIES consortium as well as from the External Layer.

5.2. Realisation

The lectures will be prepared by the partners of StoRIES and will not be longer than 30 minutes. The recorded lectures will be collected on the StoRIES webpage and open for everybody to download or watch (MOOCs for self-study).

First courses are planned for June 2022, the topics idea will be gathered within the consortium in May 2022 and the recordings will be prepared by the partners with the best expertise in the specific field. The webpage will include the possibility to propose the topics on which the future courses could be created. The option will be open to all webpage visitors.

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5.2.1. Courses content definition and execution

The first ideas for the courses will be collected by the EPMC within the StoRIES consortium via email communication in May 2022. StoRIES beneficiaries will be asked to suggest topics on energy storage that should be covered. 5 topics will be selected by the EMPC in consultation with the StoRIES Steering Committee. For the chosen topics, StoRIES experts will be asked to prepare a draft contribution, which will then be discussed in the EPMC. If agreement is reached on the input, the expert will be asked to prepare a recording of up to 30 minutes. The recording will be submitted to the StoRIES Steering Committee for approval for publication. The process should not take longer than 3 months.

The recordings will be clustered to enable gathering the knowledge on defined topic.

There will be an opportunity on the StoRIES website to suggest other topics for the courses. The EMPC will discuss the proposals every 3 months following the procedure described above.

StoRIES partners cover a wide range of expertise on various aspects of energy storage. To make the knowledge available to the public, about 30 recordings are expected to be published on the StoRIES webpage.

EMPC will provide support to the presenters in the preparation and recording of the courses.

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6. Online Platform with Existing Online Open Academic Courses on ES

6.1. Objective

The digitization also of educational activities and distance is an ongoing trend and typically educational institutions operate their own platform hosting and providing online and digital content to their customers (students, course participants). For the courses developed within StoRIES as described before, a freely accessible platform is aimed for:

- hosting the online courses for workforce from academia and industry provided by StoRIES
- hosting the online courses related to the university Master programme
- offers online material to be integrated into the StoRIES Summer Schools
- can be used by other partners for providing ES related courses and educational content

The platform will be accessible via the StoRIES website with a subsite for education aimed to be a one-stop shop for information on educational activities within the Energy storage ecosystem also in the long run including:

- Links to existing other open academic courses, relevant educational material.
- Links to other platforms, e.g., specialized EU competence platforms (like Hydrogen FC technologies FCH2edu.eu), new regulations codes and standards
- Announcement of Summer Schools, other events

6.2. Realisation

6.2.1. Platform content definition

Online courses are provided through so called Learning Management systems (LMS), which today are provided as web-based solutions offering different teaching contents (videos, text, links) as well as Assessment tools to monitor learning progress up to a summative assessment of the participants (e.g., as a grade / or passed not passed), as well as registration tools to administrate the course participants. Examples are OpenEDX as LMS, which in the EU FCH JU project NET-Tools is provided via the MOOC agency.

6.2.2. Platform implementation

Based on existing and planned course content and learning activities collected in a survey, possible LMS and providers will be explored and the most suited selected. This also includes a business concept to be developed to ensure the operation of the platform beyond the duration of the project. A governing structure as well as terms and conditions will be defined. The EPMC will be responsible for following the content and the strategic development of the platform.

Once the platform is defined and commissioned, the tools will be actively introduced and filled with the Online courses provided by StoRIES.

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7. INTERNATIONAL RESEARCH EXCHANGES

7.1. Objectives

Foster collaboration between European and international laboratories and offer European researchers access to world leading international research infrastructures or devices. Researchers from home institutes located in the EU or countries associated to Horizon Europe can visit laboratories located in non-European countries or European countries not participating in the Horizon Europe programme.

7.2. Implementation

Five calls at M12, 18, 24, 30 and 36 will be opened inviting proposals for international researcher exchange. The aims of the research exchanges are to improve the researcher's skills in the topic of energy storage, increasing their experience related to energy storage technologies, the use of experimental facilities where energy storage is involved, and activities related to the energy management including energy storage.

The results of each exchange will be described by participating partners in a report no later than 3 months after the exchange visit. These reports will be placed on a special subpage of the StoRIES website no later than the end of the calendar year in which the report was due.

The Procedure

- The applicant fills out an application form (draft of the template is included in Appendix 1: International Research Exchanges – Draft Proposal Template) and sends it to EPMC.
- The members of EPMC will evaluate the application. The evaluation results will be available 4 weeks after the deadline. Key criteria evaluation criteria will be excellence and impact.
- If the evaluation is positive, a contract is signed between the applicant, the host organisation, and the KIT as coordinator of the StoRIES project.
- After the exchange, a report on the exchange will be published on the StoRIES website and a presentation summarising the exchange at a special international exchange event. This event might be an online event.

The Financial Support

Applicants will receive financial support with travel and accommodation costs. The possible maximum amount of this support will be discussed and negotiated with the host institution, as travel costs can vary greatly depending on the location and the cost of living can also differ from those in Europe. Financial support is provided for stays lasting from 2 to 12 weeks.

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APPENDIX 1: INTERNATIONAL RESEARCH EXCHANGES – DRAFT PROPOSAL TEMPLATE

TITLE OF THE PROPOSAL

Proposals supporting the idea of hybridisation of energy storage will be given additional points in the evaluation of the proposals.

Please note that proposals with missing contact details will not be considered. The host organisation must be in a non-EU country or in a country not associated to the Horizon Europe and that the home organisation of the applicant must be in an EU country or be associated to Horizon Europe.

The start date of the exchange can be adjusted after the evaluation process.

INTRODUCTION

Describe the context of the proposal (400-650 words). Include state of the art, motivations of this proposal and specify which ES technologies are involved in the proposal.

Figures and photos are considered to cover 200 words.

SUBJECT

Describe the proposal's scientific merit (750-1000 words).

Figures and photos are considered to cover 200 words.

DETAILED WORK PLAN

Describe the detailed work plan – include Gantt chart of the actions to be performed at the host organisation (Table).

WHY

Describe why this host organisation is selected to carry out the proposed work plan. (250-500 words)

IMPACT

(250-500 words)

EXPECTED RESULTS

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Describe expected results, data or experience, deliverables … (200 words max.)

BRIEF CV OF THE APPLICANT AND HOST PARTNERS

10 lines max per person

ESTIMATION OF REQUESTED BUDGET

Provide an estimated budget with costs breakdown - (in the form of a table) *-travel expenses* *-recommended max. accommodation costs are 250€ per week, but other mounts are possible (not longer than 12 weeks)* *-an additional reimbursement of 500€ is foreseen for specific pandemic costs (e.g. tests, necessary stays in airport hotels).*

ACCESS PERIOD REQUESTED

Start date of the exchange	
End date of the exchange	
Duration of the exchange (number of days of stay)	
Number of research days (part of the above)	
Other comments	

CONTACT DETAILS

HOME ORGANISATION	
Applicant Name	
Applicant Nationality	
Applicant Place and Date of Birth	
Applicant Gender	
Applicant Phone	
Applicant e-mail	
Application Position	

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Applicant Organization Name	
Applicant Organisation Country	
Application Organisation Postal Address	

HOST ORGANISATION	
Host Organisation Name	
Host Organisation Country	
Host Organisation Postal Address	
Host Organisation Department Name	
Host Organisation Main Contact	
Host Organisation Main Contact Phone	
Host Organisation Main Contact e-mail	

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