Capacity buildnig standard for RESchools replicability

Authors : Riccardo MEREU (POLIMI)

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Former D5.2 and D5.3 A report on the monitoring data collected which will be available for consortium members and summary of the evaluated data. Guidelines and recommendations for empowering research capacity and creating synergies with existing materials and events, through the definition of a standard for institutional and human capacity building activities on technical and horizontal skills based on the past experience of LEAP-RE and testing it till the end of the project.

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Deliverable 1.19 – Capacity Building Standard for RESchools Replicability

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<u>Authors</u>:
Riccardo Mereu, PoliMi

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Summary

Guidelines and recommendations for empowering research capacity and creating synergies with existing materials and events, through the definition of a standard for institutional and human capacity building activities on technical and horizontal skills based on the past experience of LEAP-RE and testing it till the end of the project

This document defines a structured and transferable set of guidelines for capacity building activities targeting PhD candidates, Master of Science students, and early-career researchers in the field of renewable energy and energy access. Building on the validated experience of the Renewable Energy Schools (RESchools) implemented within the LEAP-RE programme, the guidelines outline a coherent framework covering the definition of training topics, teaching modalities and tools, syllabus structure, participant selection, evaluation criteria, and sustainability mechanisms. By integrating technical, horizontal, and institutional dimensions, and by emphasizing iterative learning and quality assurance, the framework provides practical guidance for designing, implementing, and replicating effective training initiatives that contribute to long-term research capacity strengthening and sustained impact across diverse institutional and geographical contexts.

Keywords

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1. Background and Rationale

Strengthening research and institutional capacity is a core pillar of the Long-Term Joint EU–AU Research and Innovation Partnership on Renewable Energy (LEAP-RE). From its inception, LEAP-RE has pursued capacity building not as an ancillary activity, but as a strategic mechanism to align scientific excellence, policy relevance, and long-term sustainability of renewable energy solutions in African contexts. This approach has been operationalised through a series of General Workshops, Stakeholder Forums, and Renewable Energy Schools (RESchools), held between 2022 and 2024 in Pretoria, Kigali, and Milan.

The proceedings of the General Workshops document how LEAP-RE progressively consolidated a multidisciplinary community of researchers, policymakers, innovators, and practitioners, fostering synergies across projects, thematic areas, and geographical contexts. These events combined scientific sessions, policy dialogue, clustering activities, and structured training initiatives, demonstrating the need for capacity building activities that address both technical competencies (e.g. data collection, energy modelling, resource assessment) and horizontal skills (e.g. scientific writing, business models, policy interaction, and stakeholder engagement). Importantly, the experience also highlighted that fragmented or project-specific training efforts, while valuable, are insufficient to ensure long-term institutional learning and cross-project coherence.

The RESchool programme, whose scientific rationale, syllabus, and organisational model are detailed in Deliverable D3.4, represents a concrete response to this need. The RESchools were explicitly designed to support PhD students, early-career researchers, and innovators through a blended format combining lectures, hands-on sessions, case studies, and seminars. Topics were selected based on internal surveys and synergy groups within LEAP-RE, ensuring alignment with ongoing research activities and identified skills gaps, particularly in data-driven planning, modelling methodologies, and socio-economic dimensions of energy access. The iterative delivery of RESchools across multiple years further allowed testing, refinement, and validation of training content and formats.

At the same time, the General Workshop proceedings reveal recurring discussions on the need to better coordinate capacity building efforts, avoid duplication, and create reusable training materials and common standards. Cluster meetings on capacity building, data collection, and energy modelling explicitly called for clearer identification of target groups, harmonisation of training objectives, and stronger integration between institutional and human capacity building activities. These discussions underscore the importance of moving from ad hoc training events toward a standardised, yet flexible framework that can be replicated beyond the duration of individual projects.

Against this background, the present deliverable builds on the accumulated LEAP-RE experience to define guidelines and recommendations for empowering research capacity and creating synergies with existing materials and events. It identifies a replicable standard for institutional and human capacity building activities, addressing both technical and horizontal skills, and grounded in approaches that have been tested in practice through successive RESchools and General Workshops. By formalising these lessons into an explicit framework, the deliverable aims to support continuity, scalability, and long-term impact of capacity building actions within and beyond LEAP-RE.

2. Definition of Training Topics

The definition of training topics builds on an evidence-based and iterative methodology developed and tested within the LEAP-RE programme through successive General Workshops, Stakeholder Forums, and Renewable Energy Schools (RESchools). As documented in the proceedings of the General Workshops, training needs were first identified through structured interactions among work packages, thematic and transversal clustering sessions, and dedicated capacity building meetings, which highlighted recurring skills gaps across research, policy, and implementation activities. These discussions revealed the necessity to address not only advanced technical competencies—such as data collection standards, renewable resource assessment, and energy system modelling—but also transversal and horizontal skills, including scientific writing, business model formulation, policy engagement, and stakeholder interaction.

This needs assessment was complemented by internal surveys and coordination within LEAP-RE Pillar 2 synergy groups, which ensured alignment between training topics and ongoing research activities. Based on this process, the RESchool syllabi were structured around a limited number of core thematic areas, explicitly documented in Deliverable D3.4, namely data collection methodologies, energy modelling approaches, and transversal socio-economic topics relevant to energy access planning. Topics were selected to balance methodological foundations with applied relevance, ensuring that training content could be directly reused in research projects and planning exercises.

The iterative delivery of RESchools across multiple editions (Pretoria 2022, Kigali 2023, Milan 2024) allowed continuous refinement of training topics based on participant feedback, observed learning outcomes, and evolving programme priorities. This iterative testing ensured that the final set of training topics reflects both demonstrated demand and practical applicability.

On this basis, the **methodology formalised in this deliverable defines training topics** through a combination of: (i) **systematic identification of skills gaps** emerging from research and policy activities; (ii) **alignment with active project** workflows and methodological needs; and (iii) **validation through repeated implementation and evaluation** in RESchool settings. This approach provides a robust foundation for defining training topics that are transferable, scalable, and responsive to real-world capacity building requirements.

Table 1 presents an illustrative example of training topics by skill type extracted by the topics developed in the RESchools 2022-2024.

Table 1 Training topics by skill type

Skill Category	Training Topics
Technical Skills	
	Data collection and management methodologies (quantitative and qualitative surveys, QA/QC, data sharing)
	Renewable energy resource assessment (solar, wind, hydro; validation of satellite and reanalysis data)
	Energy demand assessment for off-grid systems (bottom-up profiling, user archetypes, demand evolution)

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	Energy system modelling and optimal sizing (mini-grids, hybrid systems, storage integration)
	GIS-based energy planning and spatial prioritisation (site selection, electrification planning)
Horizontal Skills	
	Scientific writing and research dissemination (publication strategies, peer review, open science)
	Business models and financial sustainability of decentralized energy systems
	Policy, regulatory, and institutional frameworks for energy access
	Socio-economic assessment, stakeholder engagement, and inclusiveness
	Monitoring, evaluation, and impact assessment of energy access interventions

3. Scope and Target Groups

The RESchool standard is designed to support capacity building across multiple levels of the research and innovation ecosystem. Its primary target groups include PhD candidates, early-career researchers, and Master of Science students, who require strong methodological foundations and applied skills to engage effectively in renewable energy and energy access research. In addition, the framework addresses innovators and practitioners involved in the design, implementation, and operation of decentralized energy systems, as well as institutional stakeholders such as policymakers, funding agencies, and public authorities who shape regulatory and strategic environments.

Accordingly, the scope of the RESchool standard extends beyond individual skill development to encompass human, institutional, and systemic capacity building. Human capacity building focuses on technical and transversal competencies; institutional capacity building supports coordination, knowledge transfer, and long-term training structures; and systemic capacity building fosters alignment between research, policy, and implementation processes. This multi-level scope ensures that training activities contribute not only to individual expertise, but also to durable institutional learning and broader ecosystem development.

4. Selection of Candidates

The selection of participants is based on a transparent, merit-based, and inclusive methodology designed to align training objectives with the needs of both individuals and institutions. Selection criteria prioritize relevance of academic or professional background to the training topics, demonstrated motivation to apply the acquired skills within research or implementation activities, and the potential for knowledge transfer within the candidate's home institution or network. Basic proficiency in the working language and availability to engage fully in the training activities are considered essential prerequisites.

In addition to individual merit, the selection process explicitly incorporates balance criteria to support systemic capacity building. These include gender balance, geographical diversity, and representation of institutions with limited access to advanced training opportunities. Where applicable, priority is given to candidates involved in ongoing research, innovation, or policy processes aligned with the

thematic focus of the training. This combined approach ensures that participant selection contributes not only to individual skill development but also to broader institutional learning, network strengthening, and long-term impact of capacity building activities.

An example of a selection procedure for candidates is provided below:

- Issue an open call clearly describing training objectives, eligibility criteria, expected commitment, and support conditions.
- Collect applications including a curriculum vitae, a motivation statement, and, where relevant, institutional endorsement.
- Evaluate applications through a Selection Committee based on relevance of background, motivation, and potential for knowledge transfer.
- Apply balance criteria to ensure gender balance, geographical diversity, and inclusion of underrepresented institutions.
- Notify selected candidates and establish a reserve list to manage possible withdrawals.

This procedure ensures transparency, fairness, and alignment between training objectives and participant profiles.

5. Teaching Modalities and Tools

Teaching modalities are designed to combine conceptual understanding with applied learning, reflecting the formats successfully implemented during the LEAP-RE RESchools and General Workshops. As documented in the RESchool programmes and syllabi, training activities adopt a blended approach that **integrates lectures for methodological foundations, hands-on sessions for the application of tools and models, case studies derived from ongoing research projects, and group work to encourage peer learning and interdisciplinary exchange**. **Seminar-style sessions are used to address transversal topics**—such as policy frameworks, business models, and renewable energy communities—facilitating dialogue between technical and socio-economic perspectives. Hybrid delivery formats, combining in-person and online participation, are systematically employed where appropriate to enhance accessibility, inclusiveness, and scalability of training activities, as demonstrated across the Pretoria, Kigali, and Milan RESchools.

Teaching tools are selected to support reproducibility, collaboration, and long-term reuse of training materials. Priority is given to **open-source software and modelling platforms**, shared digital repositories for datasets and teaching resources, and **collaborative tools that enable joint exercises, assignments, and asynchronous learning**. This toolset ensures that participants can directly reuse methods and materials within their own research or institutional contexts, reinforcing continuity between training activities and ongoing project workflows. The combined use of interactive teaching modalities and open, collaborative tools has proven effective in translating training content into practical skills, while fostering durable research and institutional capacity beyond individual training events.

Table 2 provides an example of teaching methodologies and related teaching tools used in the RESchools 2022-24, including the typical outputs related to the listed methodologies.

Table 2 Teaching methodologies and teaching tools

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Teaching Methodology	Purpose	Teaching Tools (Examples)	Typical Output
Lectures	Introduce theoretical foundations and core concepts	Slide decks, recorded lectures, reading materials	Conceptual understanding
Hands-on sessions	Apply methods and tools to practical problems	Open-source modelling software, GIS platforms, datasets	Practical skills and tool proficiency
Case studies	Connect theory to real-world applications	Project documentation, policy case materials	Contextualized problem-solving
Group work	Foster collaboration and interdisciplinary learning	Collaborative platforms, shared documents	Team-based analysis and solutions
Seminars	Address transversal and socio-technical topics	Invited expert talks, moderated discussions	Critical reflection and cross-sector insights
Hybrid delivery	Ensure accessibility and scalability	Video conferencing tools, learning management systems	Broad participation and continuity

6. Definition of the Syllabus

The syllabus is structured according to a modular design that ensures flexibility, coherence, and transferability across different training contexts. It is organized into four complementary modules: foundational modules, which introduce core concepts and methodological principles; applied methods modules, which focus on the practical use of tools, data, and models; transversal skills modules, addressing horizontal competencies such as communication, policy interaction, and business models; and integration modules, where participants synthesize technical and socio-economic dimensions through case studies or project-based work. Each module defines explicit learning outcomes in terms of knowledge acquisition, practical application, critical analysis, and communication skills. Achievement of these outcomes is assessed through appropriate evaluation methods assessed through clearly defined and transparent evaluation methods, including individual or group assignments, practical exercises, case study analyses, and oral or written presentations, ensuring that learning is measurable and aligned with both academic standards and real-world capacity building objectives.

Table 3 reports an example of the main components of a syllabus

Table 3 Main components of a syllabus

Syllabus Component	Description
Course overview and objectives	Defines the scope, purpose, and relevance of the training activity within the broader capacity building framework
Target groups and prerequisites	Specifies intended participants, required background knowledge, and recommended preparatory skills
Modular structure	Organizes content into foundational, applied methods, transversal skills, and integration modules

Learning outcomes	Clearly states expected outcomes in terms of knowledge, application, critical thinking, and communication skills
Teaching modalities	Describes instructional formats such as lectures, hands-on sessions, case studies, seminars, and group work
Teaching tools and materials	Lists software, datasets, platforms, readings, and other resources used during the training
Assessment methods	Defines evaluation approaches (e.g. assignments, practical exercises, case studies, presentations) and criteria
Workload and duration	Indicates total hours, module duration, and, where applicable, ECTS or equivalent workload
Certification and recognition	Describes certificates, credits, or formal recognition awarded upon successful completion
References and learning resources	Provides key bibliographic references and additional materials for further study

7. Conceptual Framework of the RESchool Standard

The RESchool standard is grounded in a modular conceptual framework that structures capacity building activities around three complementary clusters of competencies. The first cluster focuses on Technical and Scientific Skills, encompassing methodological and analytical capabilities required for renewable energy research and energy access planning, such as data collection, resource and demand assessment, and energy system modelling. The second cluster addresses Horizontal and Transversal Skills, including communication, policy engagement, business model formulation, and socio-economic analysis, which are essential for translating technical knowledge into effective and sustainable interventions. The third cluster targets Institutional and Systemic Skills, aimed at strengthening coordination, governance, and long-term learning processes within and across institutions involved in energy access and transition initiatives. This modular architecture allows training programmes to be adapted to different contexts, target groups, and durations, while preserving a coherent structure, clear learning objectives, and consistent quality standards across RESchool implementations.

Table 4 and Table 5 report an example of mapping of module clusters to learning outcomes, coherent with the modular conceptual framework, and of mapping of modules to target groups and skills is shown for RESchools 2022-24. Topics covered by module clusters and modules refer to RESchools but can be generalised to other topics not related to the energy sector maintaining their validity as methodological approach.

Table 4 Mapping of Module Clusters to Learning Outcomes

Module Cluster	Learning Outcomes
Technical & Scientific Skills	Application of standardized methodologies for resource assessment and energy modelling
Horizontal Skills	Improved communication, policy awareness, and innovation readiness

Institutional Skills	Enhanced coordination, networking, and institutional capacity building

Table 5 Mapping of Modules to Target Groups and Skills

Module	Target Groups	Skills Developed
Renewable Resource Assessment	PhDs, Researchers	Data analysis, uncertainty assessment
Energy Modelling	Researchers, Practitioners	System design, scenario analysis
Scientific Writing	Researchers	Publication strategy, peer-review process
Business Models	Innovators, Policymakers	Economic evaluation, scalability
Policy & Regulation	Policymakers, Researchers	Evidence-based policymaking

8. Evaluation Criteria and Final Test

Evaluation is designed to assess both learning outcomes and participant engagement, with criteria covering conceptual understanding, ability to apply methods and tools to practical problems, analytical and critical reasoning skills, teamwork, and clarity of written and oral communication. Assessment is aligned with the modular structure of the syllabus and is conducted through appropriate evaluation instruments, which may include individual or group assignments, case study analyses, practical exercises using real data or tools, and oral or written presentations. Where relevant, continuous assessment is complemented by a final integrative test or project that synthesizes technical and transversal competencies. Upon successful completion of the training and assessment activities, participants are awarded a certificate of completion or achievement, formally recognizing the skills and competencies acquired.

Grading Scale, Attendance, and Pass/Fail Criteria

Assessment follows a pass/fail grading scheme. A pass is awarded when participants demonstrate satisfactory achievement of the defined learning outcomes, including adequate understanding of core concepts, effective application of methods and tools, constructive participation in group activities, and clear communication of results. In addition, a minimum level of attendance is required: as example, participants must attend at least 80% of the scheduled training activities, whether delivered in person or online. A fail is assigned when learning outcomes are not met, mandatory assessment outputs are incomplete or unsatisfactory, or the minimum attendance requirement is not fulfilled. Successful completion of both assessment and attendance requirements is a prerequisite for the issuance of a certificate of completion.

9. Sustainability and Long-Term Impact

The RESchool standard is designed to ensure sustainability beyond individual training events by promoting institutional ownership, continuity of learning processes, and integration into existing academic and research structures. By aligning training activities with doctoral schools, Master programmes, and ongoing research and innovation projects, the standard facilitates the long-term

embedding of acquired competencies within participating institutions. At the systemic level, the framework supports coherence with future African Union–European Union research and innovation initiatives, enabling reuse of training materials, replication of successful formats, and sustained collaboration across networks. This approach strengthens human and institutional capacity over time, ensuring that capacity building activities contribute to durable research ecosystems and long-term impact rather than isolated or one-off outcomes.

Here a list Criteria Supporting Sustainability and Long-Term Impact (with RESchools as an Example)

- **Embedding capacity building activities within recurring programmes or events**, as exemplified by RESchools organised alongside Stakeholder Forums, to ensure continuity, visibility, and stable participation over time.
- **Shared institutional ownership of training activities**, with multiple partner institutions contributing to design, delivery, and governance, as demonstrated by the joint organisation of RESchools.
- **Modular and reusable training structures**, allowing content developed for RESchools to be adapted, updated, and replicated across editions and institutional contexts.
- **Alignment of training topics with ongoing research and implementation activities**, ensuring that skills developed during RESchools directly support active projects and policy processes.
- **Iterative refinement of training content and formats**, using feedback and learning outcomes from successive RESchool editions to improve effectiveness and relevance.
- **Training-of-trainers mechanisms**, whereby RESchool participants and instructors are enabled to reproduce selected modules within their own institutions or networks.
- **Use of hybrid delivery formats**, as applied in RESchools, to enhance accessibility, inclusiveness, and scalability of capacity building activities.
- **Structured networking and clustering components**, modelled on RESchool sessions, to foster durable professional relationships and long-term collaboration.

10. Conclusions

These guidelines provide a transferable and structured framework for empowering young researchers and strengthening research capacity through well-designed, implemented, and evaluated training activities. The Renewable Energy Schools (RESchools) developed within the LEAP-RE programme serve as a validated example of this approach, demonstrating how the integration of technical and horizontal skills, transparent selection and assessment procedures, and sustainability-oriented design principles can be effectively operationalised in practice. By building on this tested experience, the framework supports replication across institutions and programmes while preserving coherence, quality, and long-term impact in diverse capacity building settings.

11. References

- LEAP-RE Deliverable D3.4 – Scientific Programme and Syllabus Definition of Winter/Summer Schools
- LEAP-RE Deliverable D4.5 – Proceedings from the General Workshops Horizon 2020 Model Grant Agreement