

# Accelerated Energy Storage Deployment in RELAC Countries - Integrated Workshop Series

## Background

"REnewables in Latin America and the Caribbean" or RELAC is a regional initiative across Latin America and the Caribbean (LAC) that was created at the end of 2019, within the framework of the United Nations Climate Action Summit, with the objective of reaching at least 70% of renewable energy participation in the region's electricity matrix by 2030. 16 countries are members (Barbados, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru, and Uruguay), and others are in discussions to join.

Achieving 70% or more RE will require RELAC countries to manage an increasing number and complexity of technical challenges. One of the key enabling factors for balancing increasing levels of variable renewable energy, providing ancillary services, and ensuring the stability, reliability, and resilience of the electric grid will be the effective integration and utilization of energy storage technologies. Globally, we are seeing increasing storage capacity across all scenarios (both now and as we get to higher levels of renewables like 70%). The recently completed NREL Storage Futures Study<sup>1</sup> indicates that the combination of increasing renewables on the US Electric grid along with current and anticipated dramatic cost declines in battery storage will lead to dramatic increases in energy storage capacity and duration. While focused on the US grid, this finding is consistent in almost all electric systems due to the synergies between variable renewables (PV and wind) and diurnal storage, as shown in **Figure 1**.

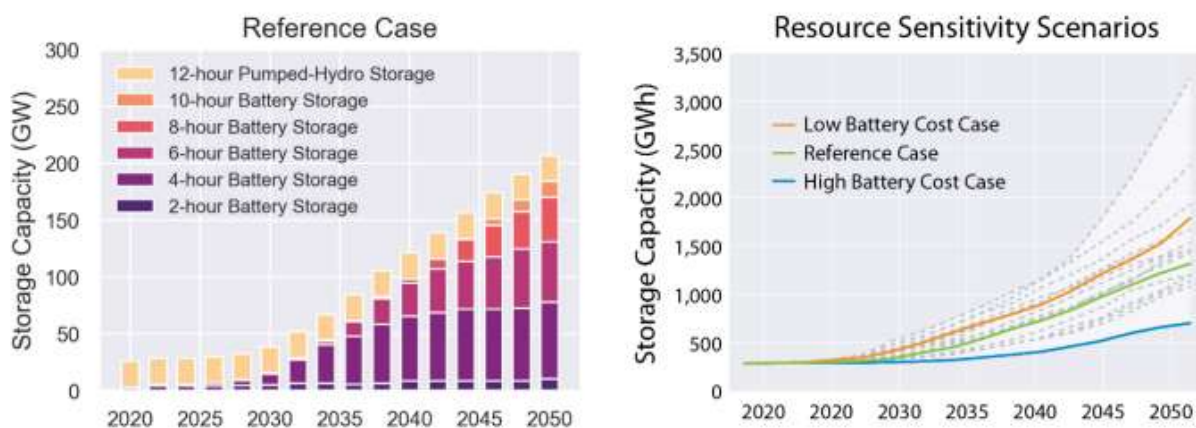


Figure 1. National storage capacity in the reference case grows to about 200 GW by 2050, deploying a range of durations (left) This translates to about 1,200 gigawatt-hours (GWh) of stored energy (right), with a wide range of deployments.

Figure 1. US Storage Capacity Scenarios through 2050

<sup>1</sup> NREL Storage Futures Study <https://www.nrel.gov/analysis/storage-futures.html>

Energy storage is a quickly evolving field and technology, and while the energy storage sector has made significant advances in markets like the US and Europe, the energy storage sector in RELAC countries is still very nascent. In fact, almost 93% of the over 15 GW of cumulative energy storage capacity deployed from 2015 to 2021 has been deployed in China, the US, Europe, South Korea, and Japan – leaving just 1.1 GW in the rest of the world including the RELAC countries.<sup>2</sup> A 2021 report from IDB estimated 111 MW of storage capacity installed in Latin America and the Caribbean with an additional 87 MW planned.<sup>3</sup> This highlights a critical need to build technical capacity, awareness of new technologies, and state-of-the-art industry knowledge to foster an overall enabling environment for energy storage in LAC. These factors will accelerate optimal deployment and utilization of energy storage, maximizing the potential of renewable energy in the region.

To address this need, the National Renewable Energy Lab (NREL) in collaboration with the Inter-American Development Bank (IDB), under the RELAC initiative, will support development of targeted and tailored energy storage proposals/action plans for the RELAC countries, a foundation to drive investment and policy action that accelerate deployment of energy storage across the region. This will be achieved through a technical capacity building workshop series focused on training key stakeholders and decision makers from the RELAC countries on a broad spectrum of topics related to energy storage including: technical applications, planning, virtual power plants, system operations, flexibility, distributed energy resources, battery economics, supply chain and manufacturing, circular economy, regulation, and key technical tools available through NREL.

During this workshop series, and with continued support from NREL specialists, the countries will propose, refine and finalize their country-specific action plans, to present at the end of the workshop series. The workshop series will be implemented as a hybrid approach, including virtual webinars, interactive discussions, dedicated technical assistance provided to all participating countries, and an in-person 1-week trip to NREL for nominated participants from each participating country to see storage technologies in operation, meet with NREL’s subject matter experts, and have the opportunity to receive tailored feedback and engage in deep-dive discussions on the country-specific action plans.

## NREL Capabilities

NREL is a world leader in energy storage research across a wide range of applications and technologies including [electrochemical storage](#) (e.g. materials R&D, electrode and system design, etc.), [stationary storage](#) (e.g. grid-integrated batteries), [storage for transportation](#) (e.g. electric vehicles), [pumped hydro storage](#), [energy storage analysis](#) (e.g. tools, data, and analysis for decision makers), and [circular economy for batteries](#) (e.g. life cycle analysis, recovery / recycling), secondary applications, etc.). See **Figure 2**.

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<sup>2</sup> International Energy Agency “Annual grid-scale battery storage additions”; Available at: <https://www.iea.org/data-and-statistics/charts/annual-grid-scale-battery-storage-additions-2016-2021>

<sup>3</sup> State of Charge – Energy Storage in Latin America and the Caribbean; Available at: <https://publications.iadb.org/publications/english/viewer/State-of-Charge-Energy-Storage-in-Latin-America-and-the-Caribbean.pdf>

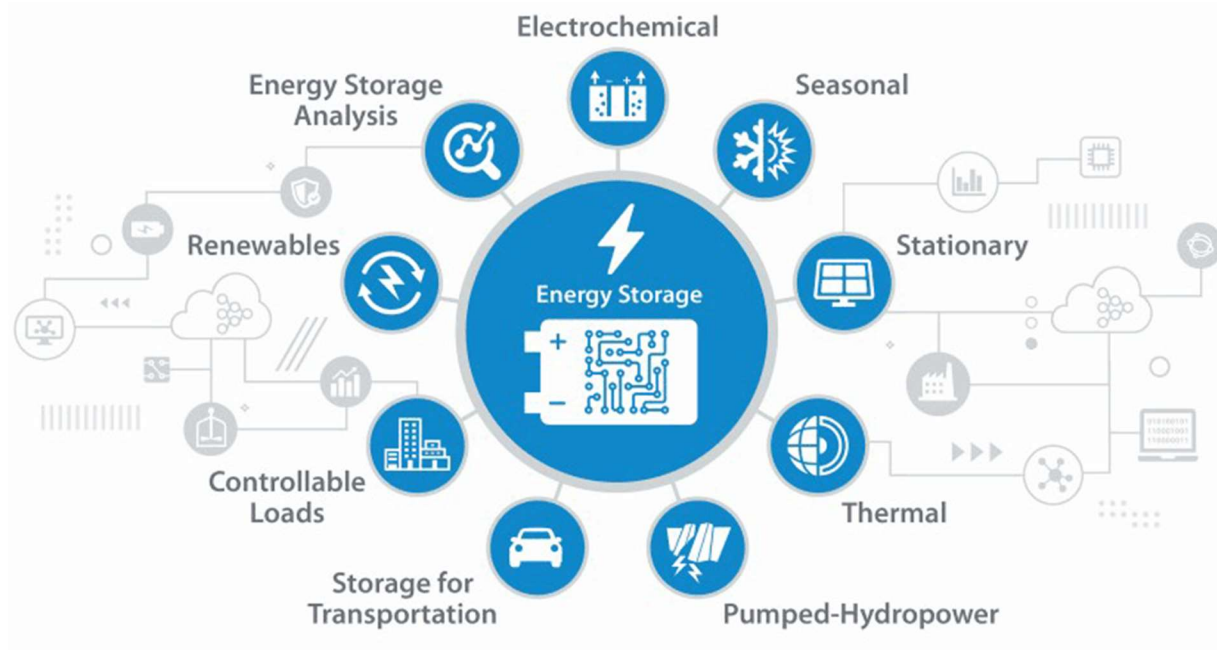


Figure 2: Spectrum of NREL Energy Storage Research

## IDB capabilities

Through financial and technical assistance IDB supports countries in LAC to deploy advanced energy infrastructure. Under the regional technical cooperation [“Enabling Energy Storage Markets in LAC for a Resilient, Low-Carbon Multisector Coupling”](#) IDB is helping countries to develop energy storage regulatory frameworks, to strengthen energy storage planning, to implement energy storage projects, and to share and disseminate knowledge.

## Objectives

The objectives of the Storage Workshop Series include the following:

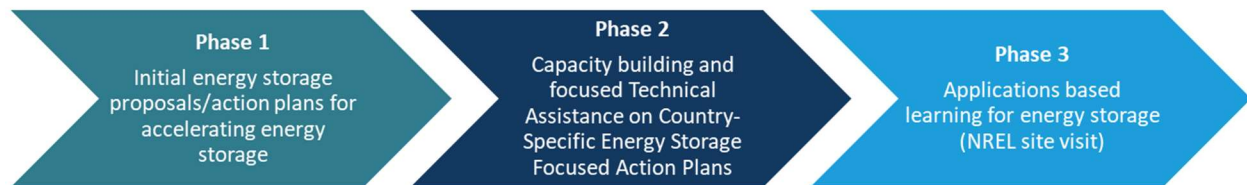
1. Technical capacity building for planning, deployment, integration, and operation of energy storage solutions for key stakeholders and decision makers in RELAC countries;
2. Support planning for increased ambition in energy storage policymaking and planning across RELAC countries;
3. Provide tailored technical assistance to help mobilize and accelerate the implementation of specific energy storage projects, initiatives or regulations in RELAC countries;
4. Build a network of energy storage stakeholders across RELAC to support future peer-to-peer learning, knowledge exchange, and support; and
5. Create recorded materials that can be shared with others throughout the LAC region, helping to increase peer-learning and knowledge transfer across LAC.

## Description of Workshop Series

### Introduction to Workshop Series

During a first introductory presentation with participants from all of the 16 RELAC member countries, NREL will present the Storage Workshop Series concept and process, including some examples of possible storage-focused action plans. Following this introductory presentation, each of the RELAC member focal points at the corresponding Ministries of Energy will select 2-3 representatives from each country to formally participate in the workshop series. Each RELAC country will have the flexibility to propose the set of participants that make the most sense for their country, but generally the participants will include a mix of regulatory and non-regulatory stakeholders working on or potentially working on energy storage applications including, but not limited to policymakers within national ministries/agencies, energy planners and system operators, technical analysts/modelers for energy storage, regulators, etc.

The workshop series will be implemented in three main phases as presented in **Figure 3**.



*Figure 3: Three Phased Approach for Energy Storage Capacity Building*

### Phase 1: Initial proposed energy storage action plans for accelerating energy storage

In the first phase, and following the selection of the participants that will participate in the workshop series, country representatives will develop an initial proposed action plan idea for energy storage in their respective countries that will be focused on specific projects, initiatives, or regulatory changes to address the challenges/barriers and advance energy storage deployment. NREL will provide participants with some example proposals/action plans and a template with key questions to fill out at the beginning of the workshop series. The proposals/action plans could potentially cover a variety of aspects of storage utilization or integration, including, for example:

- Evaluation of the potential and technical roles for energy storage in national electricity grids (e.g., spinning/non-spinning reserves, renewables capacity firming, resource adequacy voltage regulation, frequency regulation, black start, load shifting, etc.)
- Development of a regulatory framework or specific regulatory enabling conditions for supporting deployment of energy storage
- Evaluate the economics or technical benefits of co-located energy storage with new capacity expansion of utility-scale renewables
- Role of storage in increasing the penetration of electric vehicles and DER integration
- Enhancing capacity factors / improving economics of renewable energy from energy storage investment

- Utilization of pumped hydro and other energy storage for displacing baseload or ramping resources
- Analysis of behind-the-meter and/or front-of-meter energy storage opportunities
- Design and sizing of incentives to accelerate energy storage investment
- Evaluation of storage technology potential to provide needed grid services in current or planned country market framework
- Impact of energy storage on grid reliability / uptime
- Integration of energy storage into specific regulatory frameworks
- Others to be proposed by the country representatives

## **Phase 2: Capacity building and Technical Assistance on Country-Specific Energy Storage Focused Action Plans**

NREL will then conduct a series of capacity-building workshops focused on energy storage. NREL is proposing a series of seven workshops presented in **Phase 3: Applications based learning for energy storage (NREL site visit)**

The workshop series will include a week-long site visit for participants (limited to two participants per country) at the NREL campuses in Colorado. This site visit will provide participants a tour of facilities and research at NREL, presentations on the areas of research at NREL of greatest interest to the participants, an overview of NREL tools for planning and utilizing energy storage applications, as well as deep-dive presentations and conversations with NREL energy storage experts (and workshop presenters) to help provide more in-depth capacity building and training opportunities for participants.

Participants will also have the opportunity to present their country-specific energy storage action plans to storage experts from NREL, sector specialists from IDB, and potentially other partners (as identified during the project workshops), to receive additional targeted feedback and evaluate opportunities for future regulatory support, technical assistance, or finance matchmaking, as appropriate to each country-specific action plan. To be eligible for the site visit and to receive a training certificate, participants must have developed and presented their country-specific action plans and participated in a minimum of 6 of the 7 workshops.

**Table 1** below, which will be refined based on feedback from the selected participants and the topics proposed in the initial action plans. The 2-hour workshops will be conducted every 2-4 weeks to cover a variety of aspects of energy storage to provide holistic capacity building for the many stakeholder types in the sector. Certificates of completion can be earned by attending a minimum of 6 of the 7 proposed workshops. The workshops will not only help build capacity for the selected participants but will also help to inform and strengthen the country-specific energy storage action plans. During each of the workshops up to 3 countries will present the status of their action plans for peer-learning and greater awareness of regional storage-related projects or initiatives. The webinar parts of the workshops will be recorded and published online to make them accessible to broader stakeholders in LAC, raising the impact factor.

In parallel to the workshop series, NREL experts will also be providing continued technical assistance to each of the countries directly, to help them refine and accelerate the development of their country-specific action plans. This will include virtual “office hours” with relevant subject matter experts (SMEs), focused meetings with key stakeholders, and tailored technical assistance focused on solving technical problems, supporting policy or regulatory changes, or providing training on specific tools to facilitate action plan implementation.

At the end of the workshop series, the participants will present their action plans and results obtained to date to the wider RELAC audience. This will help to facilitate peer-learning and generate awareness of opportunities and solutions to help accelerate energy storage development in the LAC region.

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*Table 1: Proposed Energy Storage Capacity Building Workshops (to be refined with feedback from the participants)*

Workshop / Title	Description
<p><b>Workshop 1:</b> Summary of Energy Storage Technical Applications and planning</p>	<ul style="list-style-type: none"> <li>• Storage 101 - Storage technologies, applications, characteristics (temporal, spatial, capacity), industry trends, system services, phases of storage deployment, case studies and industry best practices</li> <li>• Overview of storage analysis and testing capabilities of NREL</li> <li>• The current and future role of energy storage in the power system, utility resource planning, and decarbonization</li> <li>• Roadmap for the incorporation of storage technologies to strengthen the penetration of renewable energy, and to support expansion of generation and transmission systems</li> </ul>

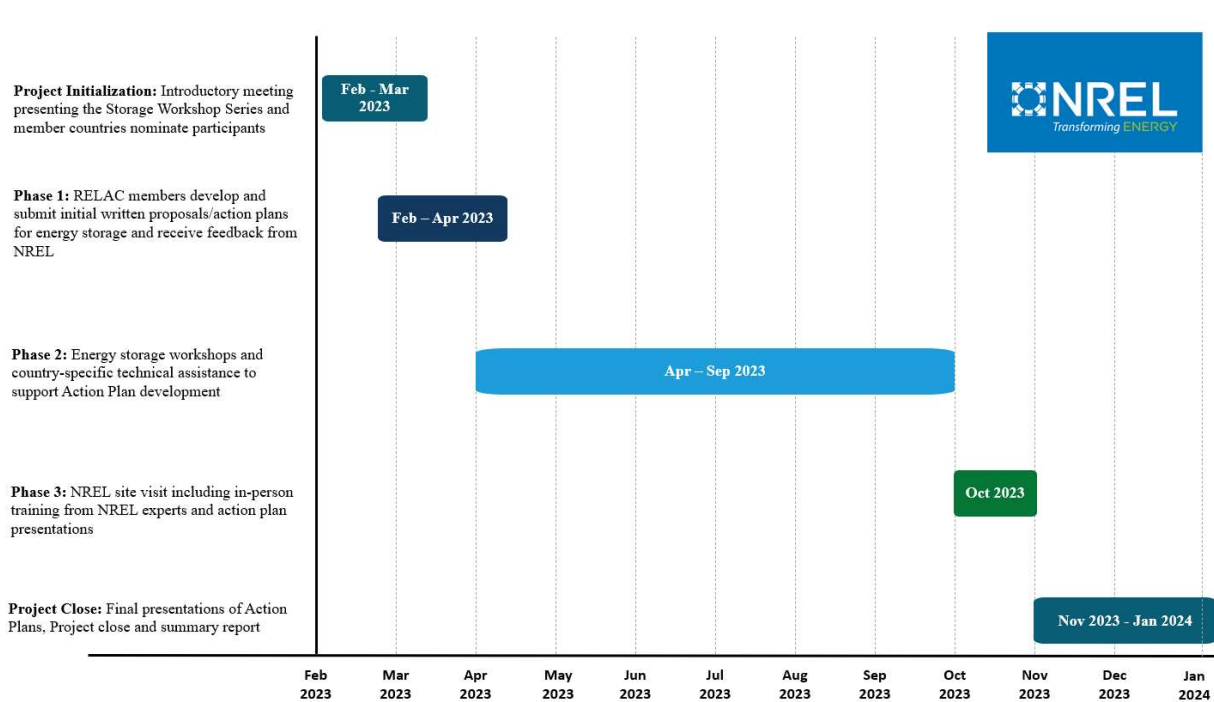
Workshop / Title	Description
<b>Workshop 2:</b> Virtual power plants, System flexibility with storage, DER and EVs	<ul style="list-style-type: none"> <li>• Virtual power plants</li> <li>• Key findings from the Solar Futures Study</li> <li>• Applications of storage technologies to improve the flexibility of the system – utility scale storage applications and examples</li> <li>• Experience of US System Operators</li> <li>• Distributed generation and storage</li> <li>• Impacts of EVs on utilities and EV battery to grid services</li> </ul>
<b>Workshop 3:</b> Economics of investing in battery systems	<ul style="list-style-type: none"> <li>• Investment considerations for storage applications / technologies</li> <li>• Role of regulation for services provided by storage</li> <li>• Cost-benefit analysis of energy storage technologies</li> </ul>
<b>Workshop 4:</b> Circular Economy	<ul style="list-style-type: none"> <li>• Circular economy and LCA of batteries</li> <li>• Studies on the reconditioning and recertification of batteries</li> <li>• Technical, regulatory and economic analysis for the use of batteries (second use) as stationary energy storage</li> </ul>
<b>Workshop 5:</b> Supply Chain & Manufacturing	<ul style="list-style-type: none"> <li>• Feasibility and competitiveness of local battery production</li> <li>• Case studies from different countries on manufacturing of batteries and components</li> <li>• Lithium reserves and opportunities for battery / EV production</li> </ul>
<b>Workshop 6:</b> Regulatory Topics	<ul style="list-style-type: none"> <li>• Regulatory changes to offer frequency regulation for renewable sources with storage</li> <li>• Regulatory framework for the incorporation of energy storage systems in electrical systems, and ancillary services</li> </ul>
<b>Workshop 7:</b> Overview of NREL Tools that can be used for battery modeling	<ul style="list-style-type: none"> <li>• General overview of NREL tools and applications for storage (SAM, REOPT, dGen, others) and incorporation in electrical planning with specific case studies and examples</li> </ul>
<b>Final Country Presentations on Action Plans</b>	<ul style="list-style-type: none"> <li>• Representatives from each country will present on their final Action Plans and developments to date. This session will be for the broader RELAC audience to facilitate peer-learning and generate awareness of opportunities and solutions to help accelerate energy storage development in the LAC region</li> </ul>

## Implementation Location

The project will provide remote technical assistance to support each of the 16 RELAC countries primarily via the energy storage workshop series which will be conducted virtually in English with simultaneous translation into Spanish (and any other languages requested by RELAC member countries). Additionally, the site visit will be conducted at NREL’s campuses in Colorado in English with Spanish translators on site during the entire site visit.

## Proposed Timeline

The workshop series is expected to follow the general timeline presented in **Figure 4** below:



*Figure 4: Timeline for Storage Workshop Series*



## Expected Impact and Indicators

The Workshop Series is expected to track a variety of top-level indicators including:

- Number of people attending energy storage capacity building workshops and number of people that receive the completion certification (disaggregated by gender and role)
- Number of institutions with improved technical capacity to design, develop, deploy, or otherwise support energy storage
- Number of energy storage proposals/action plans developed and refined as part of the energy storage capacity building workshops and technical assistance
- New installed storage capacity (MWh or GWh) and GHG emissions reduced as a result of the action plans
- New financing or partnerships leveraged for energy storage project development in RELAC countries as a result of the workshop series and technical assistance provided