

# Stakeholder-Driven Climate Adaptation in the Lao People's Democratic Republic Power Sector

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Flooding in the Mekong Delta in 2018 significantly impacted communities and the power sector in the Lao People's Democratic Republic (PDR).



Stakeholder participation is critical to power sector resilience planning. Here, Lao PDR power sector stakeholders discuss the impacts of various hazards on the power system.



In 2018, flooding in the Mekong Delta caused power outages in the Lao PDR when equipment sited within the flood zone was inundated with rising water.

## Overview

Resilient power systems are critical for economic and social development. Bringing together diverse technical solutions and integrated planning processes can foster resilient power systems to provide reliable, safe, secure electricity. In 2018, stakeholders from the Lao People's Democratic Republic (PDR) engaged in a collaborative process to assess power sector vulnerabilities and develop a resilience action plan. Outcomes and lessons learned provide a useful case study in power-sector climate adaptation planning that can serve as a model for other hydro-dependent developing nations.

## Vulnerability Assessment

Power sector vulnerability assessments evaluate the degree to which a power system or its components (e.g., generators or transmission lines) may be adversely affected by a broad range of potential hazards and threats including physical, natural, human-caused, and technological. Vulnerabilities are the weaknesses in systems or processes that could result in lost or disrupted operations when exposed to hazards or threats. The main assessment output is a prioritized list of risks to the power system based on the likelihood of threats occurring and the severity of potential vulnerabilities. Such assessments may consider physical (e.g., to power generation, transmission, and distribution infrastructure) and process-related vulnerabilities (e.g., to operations, planning, and financial systems).

Stakeholders engaged in the Lao PDR power sector vulnerability assessment concluded that extreme precipitation, extreme temperatures, flooding, and landslides pose the greatest hazards and determined the highest-risk vulnerabilities associated with these hazards included:

- Power system rules, regulations, and technical standards do not meet current and changing environmental conditions
- Dam construction does not follow design specifications
- Installation does not follow design specifications
- Design often does not comply with codes.

Stakeholders evaluated and scored vulnerabilities (see Figure 1, right) based on the following criteria:

- **Effect on delivery of power:** percent-age of service disrupted; effects on power quality
- **Effect on capital and operating costs:** additional costs for reliable operation of the power system
- **Extent of health and safety impacts to the population:** public health and safety metrics
- **Extent of environmental effects:** metrics on release of toxic materials, effects on biodiversity, changes to area ecosystems, and impacts on historic sites, among others.

VULNERABILITIES	Vulnerability Severity Score	THREATS												
		Extreme Precipitation	Extreme Temperatures	Flooding	Landslides	Wildfires	Winds	Human Actions: Bad Actors	Human Actions: Accidents	Technological Design	Technological Materials	Technological Vulnerability	Drought	Lightning
		Threat Likelihood Score												
Power system rules, regulations, and technical standards do not meet current and changing environmental conditions	9	81	83	83			45	45	45					
Corruption leads to code violations	9	81	83	83	45	45	45	45	45	45				
Dam construction does not follow design specifications	9	81	83	83	45	45	45	45	45	45				
Installation does not follow design specifications	9	81	83	83	45	45	45	45	45	45				
Lack of compliance with codes in design	9	81	83	83	45	45	45	45	45	45				
System operations are not flexible enough to respond to changes in demand and supply	7	63	49	49		35		35		35	7			
Demand forecasting is not responsive to changing load conditions	7	63	49					35		35				
Heavy power sector reliance on hydro generation	7		49	49				35		35				
Inadequate domestic generation capacity requires costly energy imports	7		49	49	49	35	35	35	35	35	35			

Figure 1. Finalized resilience action plan

## Resilience Action Planning Process

- The power system of the Lao PDR is essential to providing reliable, secure, and affordable electricity and to driving growth and development in the country.
- The power system faces potential risks from natural, technological, and human-caused hazards that could disrupt the power supply.
- The Lao PDR recognizes a resilient power system could thrive under changing conditions and withstand, respond to, and recover rapidly from disruptions.

Lao PDR power sector resilience action planning consisted of four main tasks (see Figure 2, right, for details):

- Task 1. Identify Resilience Solutions
- Task 2. Score and Prioritize Resilience Solutions
- Task 3. Group Resilience Solutions into Resilience Actions for Implementation
- Task 4. Finalize Resilience Action Plan

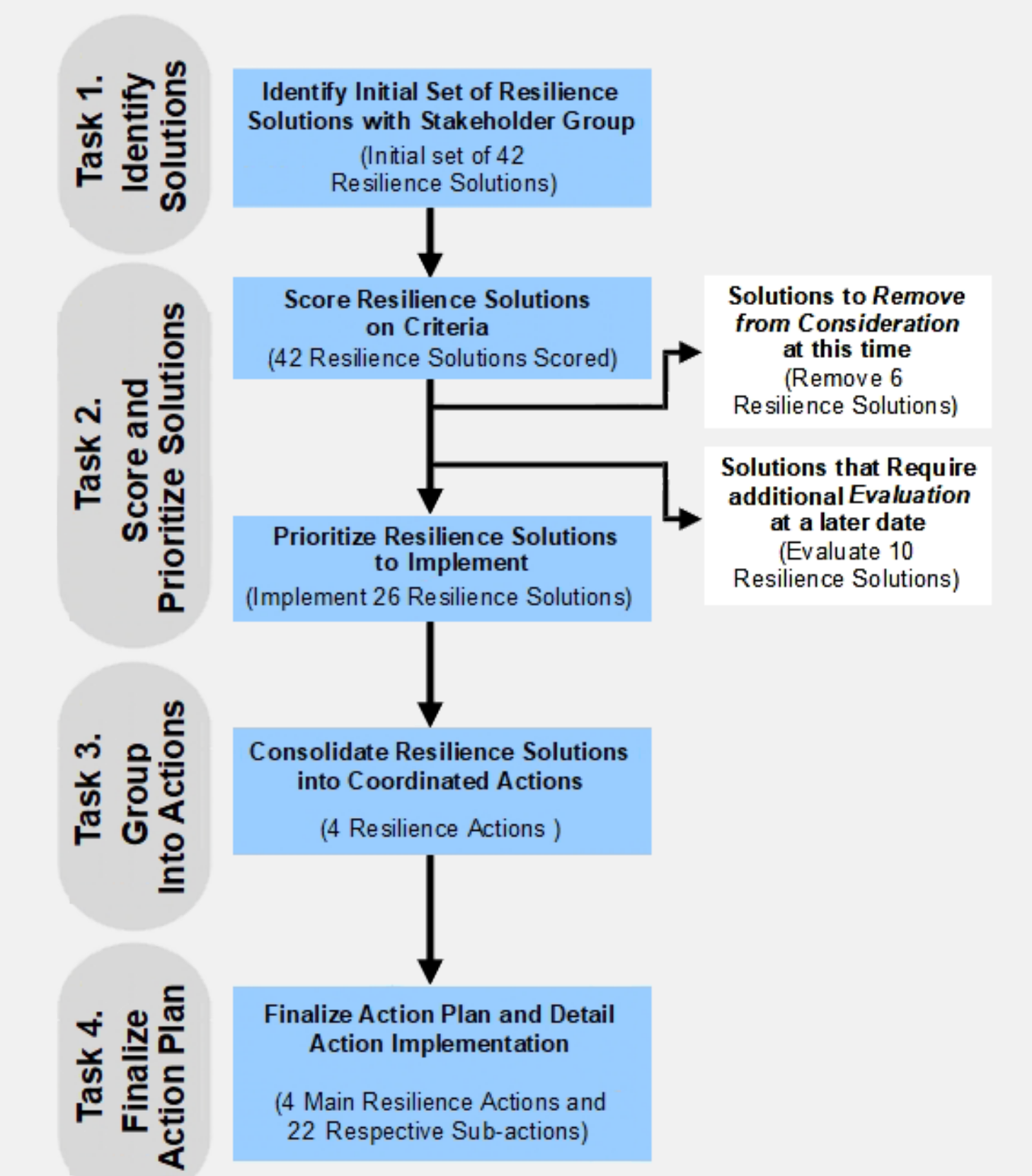


Figure 2. Process flow of Lao PDR resilience action planning

## Risk-Mitigation Strategies

The resulting resilience action plan outlines strategies to address the high-risk vulnerabilities identified in the vulnerability assessment. The final set of resilience actions were grouped into four categories: Power Sector Resilience Policy, Improving Power System Flexibility, Improving Dam Coordination, and Facilitating Better Watershed Management. Individual activities are detailed in each category to facilitate implementation of the resilience action plan (Figure 3, below).

Months 1-6	Months 7-12	Months 13-18	Months 19-24	Beyond Month 25
<b>Action 1. Develop and Implement Resilient Power System Policies</b>				
Activity 1.1 Develop standard operating procedures and continuity of operation plans for extreme events - including staffing plans, prioritized re-powering of networks, and aid agreements with neighboring countries				
Activity 1.2 Develop climate projections and geospatial data for hydropower and other generation planning, make these maps available publicly - including developers, and include policy provision that asset development will only occur within pre-selected zones				
Activity 1.3 Develop standards and enforcement mechanisms for power reliability				
Activity 1.4 Improve community readiness for extreme events that may impact the power sector				
Activity 1.5 Improve enforcement of dam design and construction codes - including planning for expected hazards (such as floods, high winds, landslides) where these cannot be avoided				
Activity 1.6 Include resilience provisions within annual operating budgets of relevant agencies				
<b>Action 2. Improve Power System Flexibility</b>				
Activity 2.1 Consider multiple demand and supply scenarios for power system growth in the power development plan and related planning activities				
Activity 2.2 Reduce dependence on hydropower through diversification of energy mix				
Activity 2.3 Introduce Flexibility Solutions into Power System Operations				
Activity 2.4 Improve power system planning for future scenarios including education for dispatch scenarios, weather forecasting for variable renewable energy, and knowledge of demand forecasting methods				
Activity 2.5 Develop and implement a demand side management program to reduce peak electricity demand (such as time-of-use tariffs, industry and large customer programs, or public awareness and educational campaigns)				
Activity 2.6 Establish a binding contract or agreement within an interconnection procedure to ensure commitment of new large electrical customers such as large industrial loads				
<b>Action 3. Improve Coordination across Hydropower Dam Operations</b>				
Activity 3.1 Establish protocol for data collection at all hydropower dams including data types, collection frequency, and data format for sharing				
Activity 3.2 Mandate data sharing between hydropower dam operators				
<b>Action 4. Facilitate Better Sedimentation Management in Hydropower Watersheds</b>				
Activity 4.1 Develop incentive and enforcement structures to ensure that users and/or areas that are upstream from hydropower dams protect watersheds located upstream from hydropower dams				
Activity 4.2 Create educational campaign and community awareness for watershed protection upstream from hydropower dams				

Figure 3. Example of vulnerability scoring sheet