USAID
FROM THE AMERICAN PEOPLE

USAID CLEAN POWER ASIA

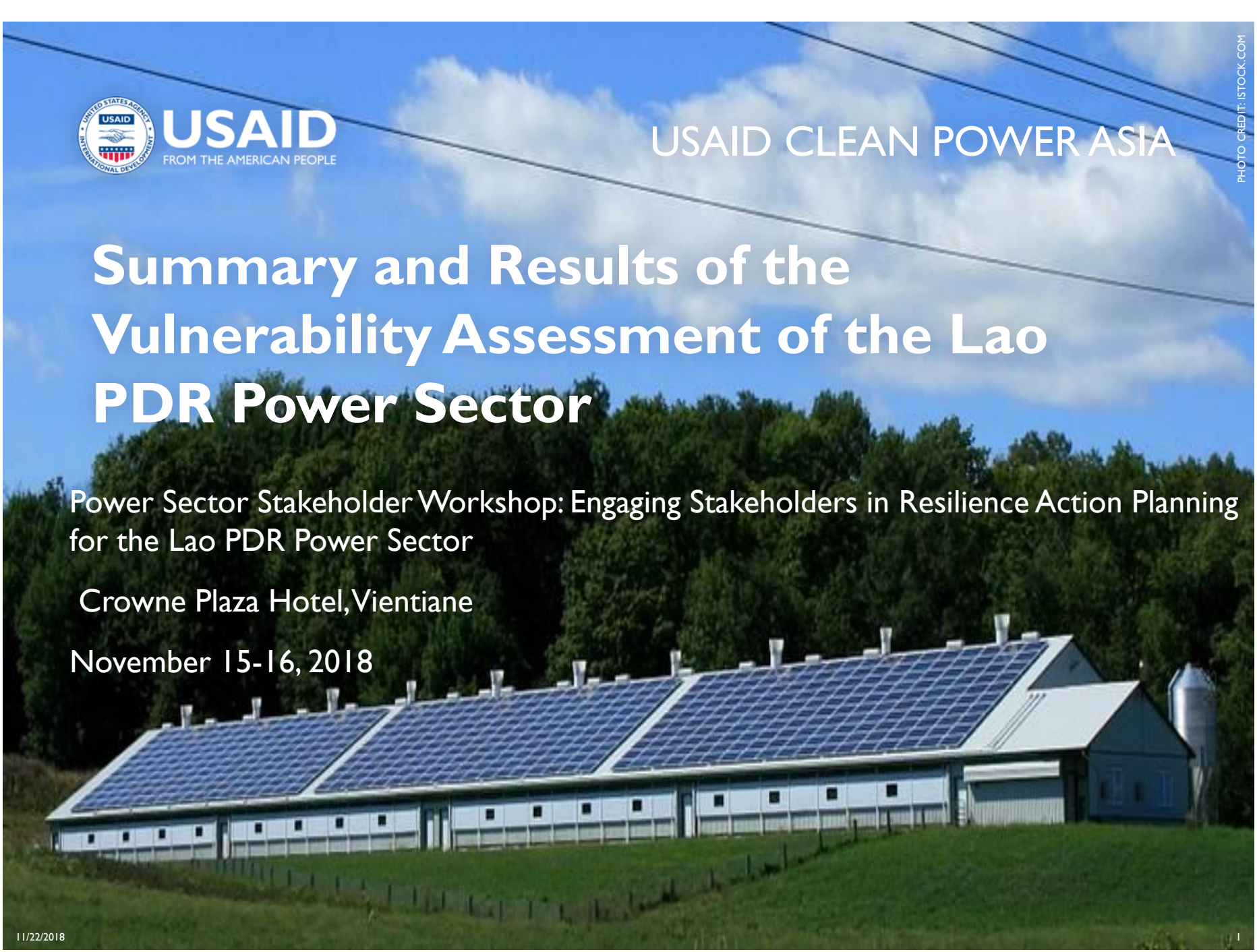
PHOTO CREDIT: ISTOCK.COM

Summary and Results of the Vulnerability Assessment of the Lao PDR Power Sector

Power Sector Stakeholder Workshop: Engaging Stakeholders in Resilience Action Planning for the Lao PDR Power Sector

Crowne Plaza Hotel, Vientiane

November 15-16, 2018



Overview of Vulnerability Assessment (VA) and Resilience Planning Process

- USAID Clean Power Asia and the National Renewable Energy Laboratory (NREL) assessed the Lao PDR power sector's vulnerabilities to climate and non-climate hazards
  - VA approach involved extensive stakeholder engagement
    - VA Advisory Group discussed the appropriate scope for the VA and identified priority hazards
    - Power sector staff conducted VA with VA team during three-day workshop
- USAID Clean Power Asia and NREL collaborating with stakeholders again to develop a resilience action plan

August 2018 VA Stakeholder Workshop Goal and Objectives

- Workshop Goal
  - Engage power sector stakeholders in identifying and assessing the sector's vulnerabilities to current and projected climate and non-climate hazards.
- Workshop Objectives
  - Identify and discuss power sector vulnerabilities associated with current and projected climate and non-climate hazards.
  - Discuss participants' experiences with past climate and non-climate hazards and how these hazards affected the power sector activities that they manage.
  - Discuss participants' perceptions of projected hazards and how these hazards could affect the power sector activities that they manage.
  - Assess, evaluate, and prioritize the most important vulnerabilities.

VA Approach

- Develop impacts framework and finalize with stakeholder feedback
- Identify natural and non-natural hazards to the power sector and describe their impacts
- Develop list of potential vulnerabilities in the power sector and associate vulnerabilities with relevant hazards
- Score severity and likelihood of potential vulnerabilities
- Score potential vulnerabilities for overall risk
- Identify highest-risk vulnerabilities

Final Impacts Framework

Objectives		Energy system components										
		Hydro Generation	Thermal generation	Generator step up transformer	Transmission lines	Substation step-down transformer	Distribution lines	Point of common coupling	Residential demand	Small commercial demand	Large Commercial and Industrial demand	Grid operations/ management
Reliability and security	Availability											
	Continuity of service											
	Good power quality											
	Skilled workforce											
Affordability	Appropriate rates											

Final List of Hazards to Lao PDR Power Sector

Natural Hazards
Cyclone (including extreme precipitation, landslides, and wind)
Drought
Extreme heat and cold
Lightning
Non-Natural Hazards
Technological (design, workmanship, low quality and defective materials)
Wildlife interactions
Human-caused accidents

Vulnerabilities and Associated Hazards

- Power Sector Stakeholder Group identified 32 potential vulnerabilities
- Table shows subset of vulnerabilities and associated hazards

Hazards	Power system rules, regulations, and technical standards do not meet current and changing environmental conditions	Corruption leads to code violations	Dam construction does not follow design specifications
Extreme Precipitation	Yes	No	Yes
Extreme Temperatures	Yes	No	No
Flooding	Yes	No	Yes
Landslides	Yes	No	Yes
Wildlife interactions	No	No	No
Wind	Yes	No	No
Human Actions: Bad Actors	No	Yes	Yes
Human Actions: Accidents	No	No	Yes
Technological Design	Yes	No	Yes

Severity Scoring

Vulnerability Severity Score		Threshold Descriptions
Qualitative	Quantitative	
High	9	Highest magnitude of consequence. Entire power system would be impacted. Extreme financial impacts would exist.
Medium-High	7	Significant consequences to the organization. Majority of population served would be impacted. Staff tasks would be switched to emergency/critical operations. Significant financial impacts would exist
Medium	5	Medium magnitude of consequence. The organization would be somewhat affected. Specific systems or functions would be substantially interrupted, but not all. Financial impacts would be expected to change budgeting plans or require reallocation of funds.
Low-Medium	3	Slightly elevated consequence to the organization. The power sector may need to temporarily transition operations to backup systems to resolve failure. Limited financial impacts may become apparent.
Low	1	Lowest magnitude (or severity) of consequence to the organization. The power sector would experience little to no affect or an in-place backup system would resolve the failure.

Subset of Severity Scores

Number	Vulnerability	Severity Score
29	Power system rules, regulations, and technical standards do not meet current and changing environmental conditions	High
16	Corruption leads to code violations	High
13	Dam construction does not follow design specifications	High
21	Installation does not follow design specifications	High
12	Lack of compliance with codes in design	High
20	System operations are not flexible enough to respond to changes in demand and supply	Medium-High
17	Demand forecasting is not responsive to changing load conditions	Medium-High
7	Heavy power sector reliance on hydro generation	Medium-High
31	Inadequate domestic generation capacity requires costly energy imports	Medium-High

Likelihood Scoring

Hazard Likelihood Scores		Threshold Descriptions
Qualitative	**Quantitative**	
High	9	Almost certain to occur. Historic and frequent occurrences.
Medium-High	7	More likely to occur than not.
Medium	5	May occur.
Low-Medium	3	Slightly elevated level of occurrence. Possible, but more likely not to occur.
Low	1	Very low probability of occurrence. An event has the potential to occur but is still very rare.

Likelihood Scores

Hazard	Likelihood score
Natural Hazards	
Extreme precipitation	High
Flooding	Medium-High
Extreme temperatures	Medium
Landslides	Medium
Wind	Medium
Drought	Medium
Lightning	Low
Non-Natural Hazards	
Human bad actors	Medium
Technological poor design	Medium
Technological poor materials	Medium
Human accidents	Low-Medium
Technological poor workmanship	Low-Medium
Wildlife interaction	Low-Medium

Risk Scoring and Subset of Final Risk Matrix

Vulnerability	Consequence score	Extreme Precipitation	Flooding	Extreme Temperatures	Landslides	Wind	Human Actions: Bad Actors	Technological Design	Technological Materials	Drought	Wildlife Interactions	Human Actions: Accidents
Likelihood score		9	7	5	5	5	5	5	5	5	3	3
Power system rules, regulations, and technical standards do not meet current and changing environmental conditions	9	81	63	45	45	45		45	45	45		
Corruption leads to code violations	9						45					
Dam construction does not follow design specifications	9	81	63		45		45	45	45			27
Installation does not follow design specifications	9	81	63		45		45	45				27
Lack of compliance with codes in design	9	81	63		45			45	45			
System operations are not flexible enough to respond to changes in demand and supply	7	63	49	35		35		35		35		

Highest-Risk Vulnerabilities

- Extreme precipitation and flooding hazards expose the highest-risk vulnerabilities
  - 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
  - Lack of compliance with codes in design

Other High-Risk Vulnerabilities (I)

- System operations are not flexible enough to respond to changes in demand and supply
- Demand forecasting is not responsive to changing load conditions
- Heavy power sector reliance on hydro generation
- Inadequate domestic generation capacity requires costly energy imports
- Large industry (mining, cement, economic zones) constitutes approx. 40% of demand and revenue

Other High-Risk Vulnerabilities (II)

- Poor coordination among dam operators
- Transmission equipment located in zones prone to flooding
- Transportation impacts occur with power sector impacts
- Unreliable and/or inadequate meteorological, hydrological, climate change data for decision making

Group Activity to Validate VA Results

- In small groups, review the vulnerabilities that received lower overall risk scores in the VA
  - Even though they are not high-risk vulnerabilities, are there vulnerabilities on this list that should be addressed in the resilience action plan?
- Consider the ranking of each vulnerability in relation to the others.
  - Based on your experience, do the relative rankings make sense?